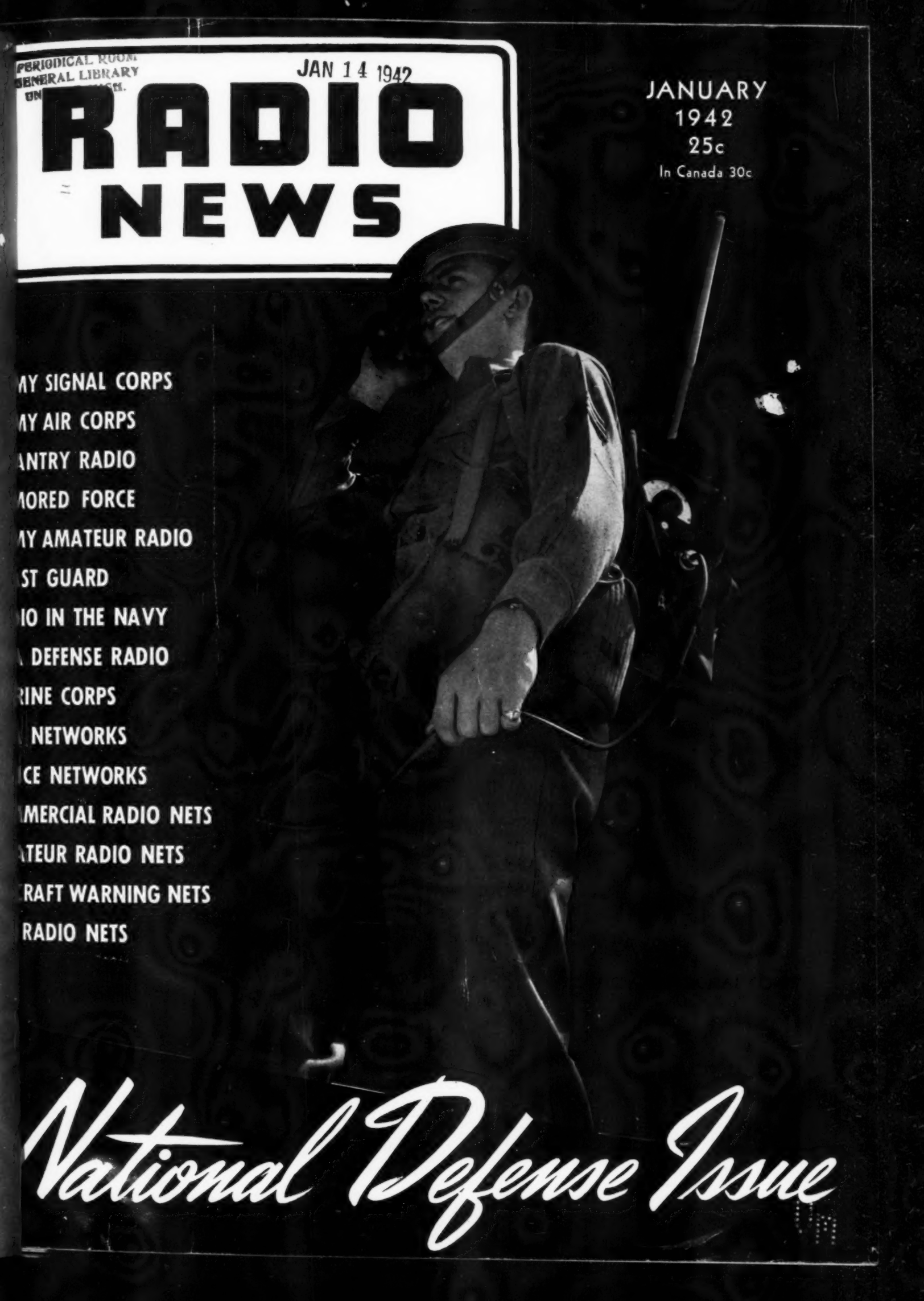
RADIO NEWS

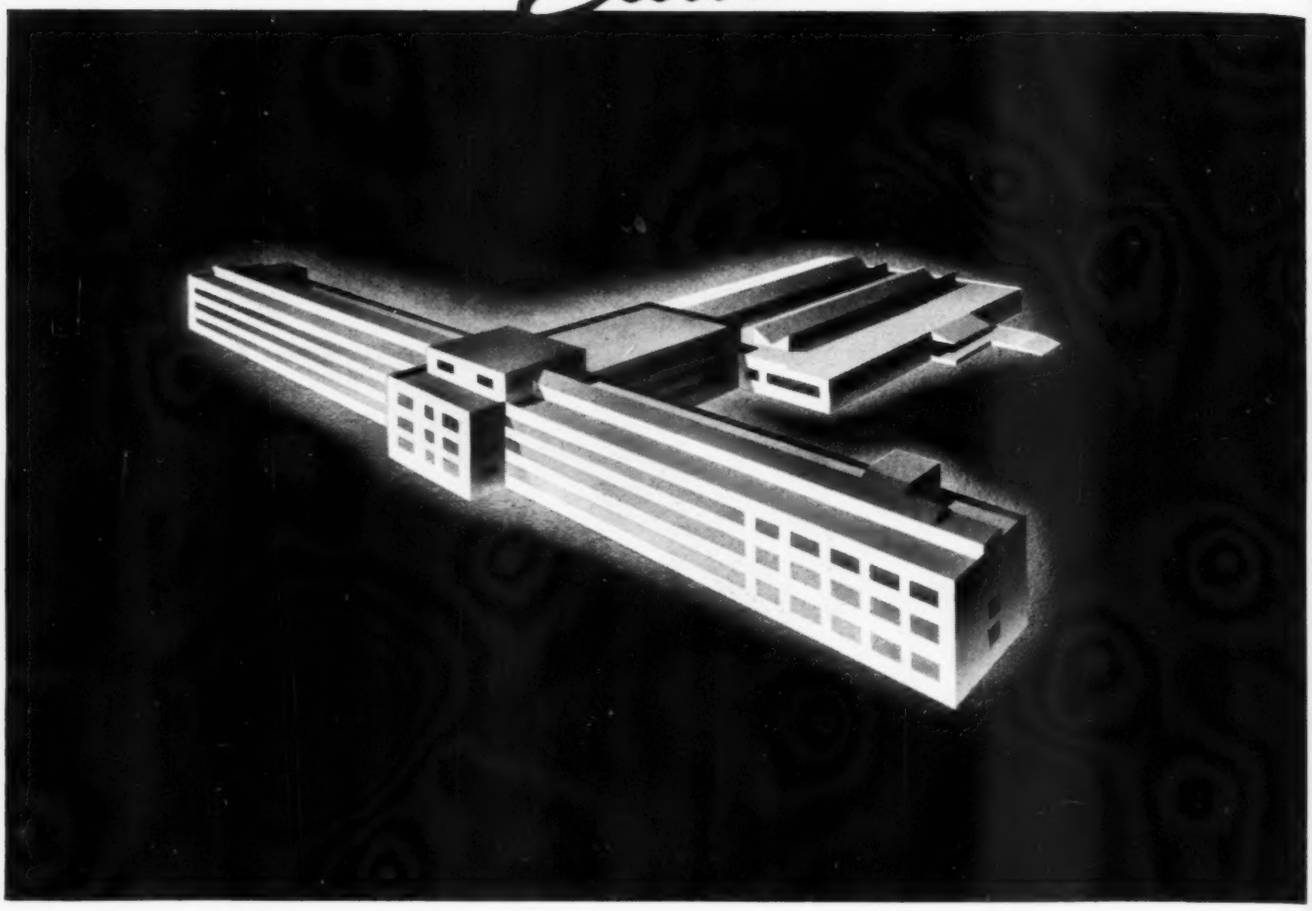
JANUARY
1942
25c
In Canada 30c



AY SIGNAL CORPS
AY AIR CORPS
ANTRY RADIO
MORED FORCE
AY AMATEUR RADIO
ST GUARD
IO IN THE NAVY
DEFENSE RADIO
RINE CORPS
NETWORKS
ICE NETWORKS
MERCIAL RADIO NETS
TEUR RADIO NETS
RAFT WARNING NETS
RADIO NETS

National Defense Issue

This is the House *Electrons* are Building



"GREAT OAKS from little acorns grow"—In radio, great services from little electrons grow. Electrons—tiny bits of electricity—are corpuscles of science in the lifeblood of radio progress.

Electronics took wireless out of the spark gap and put it into the vacuum tube oscillator; it lifted radio off the cat-whisker of the crystal detector and placed it in the electron tube, acting as both detector and amplifier. Electronics gave wireless a voice—the radiophone, now called broadcasting.

Today in the Electronic Age, a new structure—RCA Laboratories—is being built on 260 acres at Princeton, N. J., planned to be the foremost radio research center in the world. Here in surroundings that inspire clear thinking and research, scientists of RCA Laboratories will seek new truths. They will develop new inventions and services for radio, for industry and for people everywhere, because Electronics is an ever-broadening field.

The main section of RCA Laboratories—the House that Electrons are Building—will be ready for occupancy in the Spring of 1942. And with its opening, a new gateway to the future of radio swings wide for the benefit of America and all the civilized world.

RCA LABORATORIES

A Service of the Radio Corporation of America

Other RCA Services: RCA Manufacturing Company, Inc. • Radiomarine Corporation of America • R. C. A. Communications, Inc.
National Broadcasting Company, Inc. • RCA Institutes, Inc.

I WILL TRAIN YOU TO START

A SPARE TIME OR FULL TIME

RADIO SERVICE BUSINESS WITHOUT CAPITAL

I Trained These Men

I Trained These Men

YOU Build These and Other Radio Circuits

with Standard Radio Parts I Send You With My Course

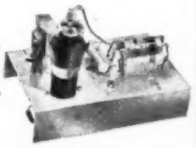
I send you SIX BIG KITS of Standard Radio Parts as part of my Course. With them you conduct SIXTY sets of experiments, build, test and align Radio circuits, and secure the experience needed to make extra money while learning.

Super-Heterodyne Receiver

with preselector, oscillator-mixer-first detector, intermediate frequency stage, diode detector-a.v.c. stage and audio stage, which you build from parts I send you in my SIX Big Kits.

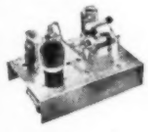
Measuring Instrument

you build early in the Course. This instrument, known as the N.R.I. Tester, is a vacuum tube voltmeter and multimeter with a sensitivity better than 20,000 ohms-per-volt. You will be able to make the following measurements: a.c. volts up to 550 in 4 ranges; d.c. volts up to 450 in 4 ranges; d.c. currents up to 45 ma. in 2 ranges; resistance values up to 100 meg. in 4 ranges; output measurements of receivers in 4 ranges.



F. M. Signal Generator

really a miniature frequency-modulated transmitter. With it you study frequency modulation, the newest method of Radio communication.



A. M. Signal Generator

The circuit is exactly like the signal generator the serviceman uses. It provides an amplitude-modulated Radio signal for experimental purposes.

You Get This Professional Radio Servicing Instrument

as part of my Course—without extra charge—to help you make more money, do better Radio work. For full details mail the Coupon.

FREE LESSON

Get my Sample Lesson, "Radio Receiver Troubles—Their Cause and Remedy," now. See how completely this ONE TEXT covers a long list of troubles in all types of receivers. A special section is devoted to receiver check-up, alignment, balancing, neutralizing, testing. See for yourself how complete, how practical, my Lesson Texts are. MAIL THE COUPON.

These Men Have SPARE TIME BUSINESSES

"I repaired many Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half, and I have made an average of $10—just spare time."
JOHN JERRY
1729 Penn St.
Denver, Colo.

"I do Radio Service work in my spare time only, operating from my home, and I net about $40 a month. I was able to start servicing Radios 3 months after enrolling with N.R.I."
WM. J. CHERMAK
R. No. 1, Box 287
Hopkins, Minn.

"I am doing spare time Radio work, and I am averaging around $500 a year. Those extra dollars mean so much—the difference between just barely getting by and living comfortably."
JOHN WASHKO
97 New Cranberry
Hazleton, Penna.

These Men Have FULL TIME BUSINESSES

"For several years I have been in business for myself making around $200 a month. Business has steadily increased. I have N.R.I. to thank for my start in this field."
AILLIE J. FROEHNER
300 W. Texas Ave.
Goose Creek, Texas

"I went into business for myself 6 months after enrolling. In my Radio repair shop I do about $300 worth of business a month. I can't tell you how valuable your Course has been to me."
A. J. BATEN
Box 1168
Gladewater, Texas

"I am making around $50 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N.R.I."
H. W. SPANGLER
1261½ S. Gay St.
Knoxville, Tenn.

The men above are just a few of many I have trained at home in spare time to be Radio Technicians. Today they are operating their own successful spare time or full time Radio businesses. Hundreds more of my men are holding good jobs in practically every branch of Radio, as Radio Technicians or Operators. Aren't these men PROOF that my 50-50 method of training gives you, in your spare time at home, BOTH a thorough knowledge of Radio principles **and the practical experience you need** to help you make more money in the fast-growing Radio industry?

Train This Practical N.R.I. Way "Learn It, Do it, Prove It"

My Course is NOT just "book-work" training! No indeed! You get practical experience with Radio parts and test equipment almost from the start. First you **LEARN** the fundamental facts about Radio parts and circuits by reading my Lesson Texts, prepared especially for home study training. Next, you **DO** what you have learned, by working with these parts and circuits. **Doing** with your own hands and **seeing** with your own eyes makes you remember what you learn. Finally, you **PROVE** what you learn by making measurements with your test equipment before and after you change your Radio circuits or adjust your Radio parts.

You Get SIX Large Kits of Standard Radio Parts

In all, I send you Six Large Practical Kits which contain more than 100 standard Radio parts, including tubes, condensers, resistors, punched chassis bases, a meter, a soldering iron, solder, hook-up wire, hardware and a host of other Radio parts. With all these, you perform 60 different sets of experiments—you make hundreds of tests and measurements and secure a wealth of practical experience. You build the N.R.I. Tester (see column at left), and learn how to use it to measure voltage, current, and resistance. You build dozens of different Radio receiver and transmitter circuits one after another, and secure practical experience with each. You learn how to recognize, locate and repair troubles in Radio circuits. You also get my specially designed Professional Set Servicing Instrument (see bottom of column at left).

Beginners Quickly Learn to Earn, $5, $10 a Week Extra in Spare Time

I show you, too, how to get practical servicing experience at home with your Professional Set Servicing Instrument. Many begin doing real Radio work in their neighborhood only a few months after enrolling. Furthermore, right from the start I begin sending you Practical Job Sheets—over three dozen in all—which give plans and directions for doing increasingly more profitable Radio servicing jobs. This is why so many of my students start building their own spare time Radio businesses while still learning, and make $5 to $10 a week extra.

It's Smart to Train for Radio Now —for Good Jobs Like These

Radio is one of the country's busiest industries. In addition to a large demand for Radio sets and equipment for civilian use, the Radio industry is getting millions and millions of dollars in defense orders. The 882 broadcasting stations in this country employ thousands of Radio Operators and Technicians. Operators are badly needed for the U. S. Merchant Marine, and salaries are higher than ever before for these adventurous jobs. It takes thousands of Radio servicemen to keep this country's 50,000,000 home and auto Radios working. Aviation, Police and Commercial Radio systems are booming. Public Address work means real money for trained Radio men. Television is now on a commercial basis, and promises good jobs soon. My Course can lead you to a good job in **any of these** profitable fields.

Extra Pay in Army, Navy, Too

Every man likely to go into military service—every soldier, sailor, marine—should mail the Coupon Now! Learning Radio helps men get extra rank, extra prestige, more interesting duty at pay up to 6 times a private's base pay! Also prepares for good Radio jobs after service ends. IT'S SMART TO TRAIN FOR RADIO NOW!

MAIL THE COUPON NOW—for a Sample Lesson and 64-page book FREE. Get the details of how I can give you practical training to be a Radio Technician at home in your spare time. Find out about my Course, my 6 Big Kits of Radio Parts, my Professional Radio Servicing Instrument. Read letters from more than 100 men I trained, so you can see what they are doing and earning. MAIL THE COUPON in an envelope, or paste it on a penny postcard.

J. E. SMITH, President
Dept. 2AR
National Radio Institute
Washington, D.C.

GOOD FOR BOTH 64 PAGE BOOK SAMPLE LESSON FREE

J. E. SMITH, President, Dept. 2AR
National Radio Institute, Washington, D. C.

Without obligating me, mail your Sample Lesson and 64-page book FREE. I am particularly interested in the branch of Radio checked below. (No salesman will call. Write plainly.)

- ☐ Radio Service Business of My Own
- ☐ Service Technician for Radio Stores and Factories
- ☐ Spare Time Radio Servicing
- ☐ Auto Radio Technician
- ☐ Aviation Radio
- ☐ Operating Broadcasting Stations
- ☐ Army, Navy Radio Jobs
- ☐ Operating Police Radio Stations
- ☐ Operating Ship and Harbor Radio

(If you have not decided which branch you prefer—mail coupon for facts to help you decide.)

Name..... Age.....

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City..... State.....14X-1

SPECIAL *National Defense* ISSUE

Volume 27
Number 1

RADIO NEWS

CONTENTS *January, 1942*

Pictures in this issue were furnished by courtesy of the Signal Corps, NYA, CCC, Marine Corps, ARRL, Farnsworth, War Dept., Army Air Corps, Coast Guard, NBC, Doolittle, U. S. Navy, Dept. of Commerce and from photos owned by Radio News.

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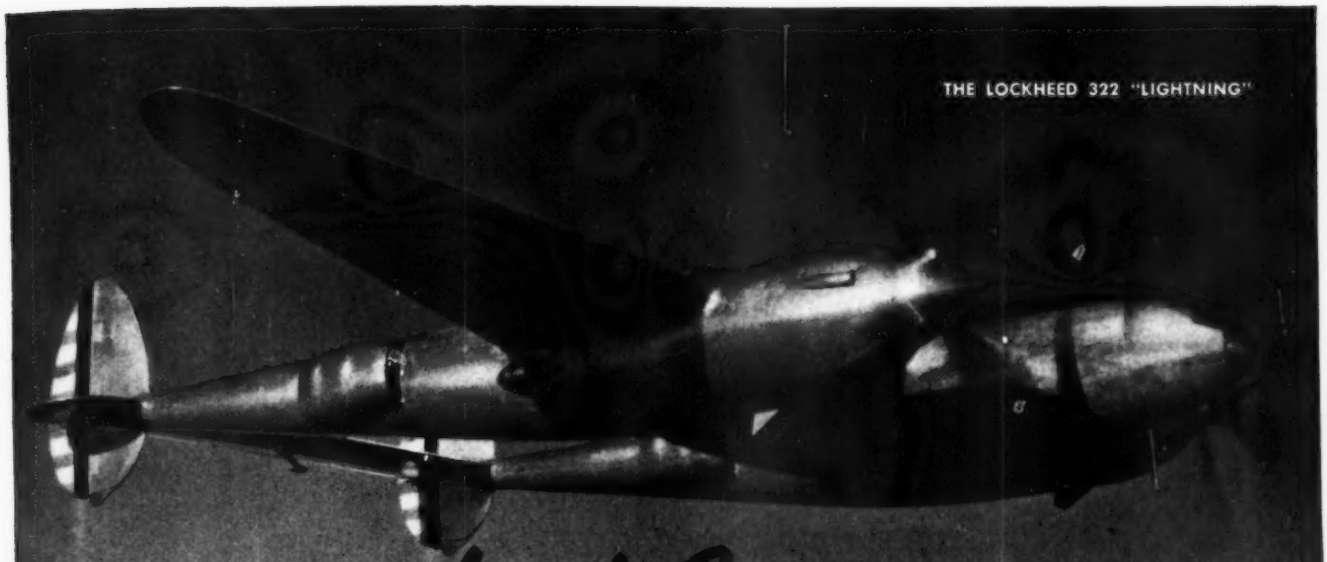
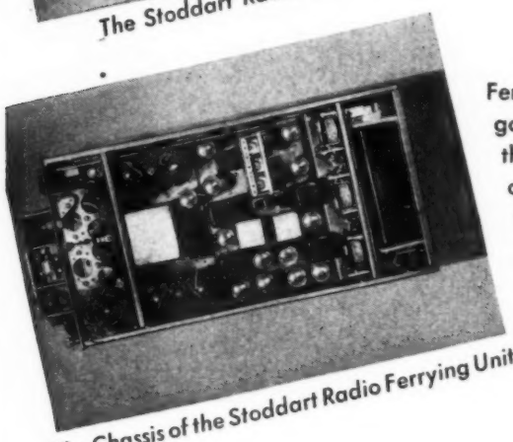


SYLVANIA *Lock-In* TUBES SERVING IN FERRYING EQUIPMENT OF FAMOUS WAR PLANES

The Stoddart Radio Ferrying Unit



The Chassis of the Stoddart Radio Ferrying Unit

THE Lockheed 322 "Lightning," British version of the P-38 and the Hudson, a bomber, is equipped with Sylvania "Lock-In" Tubes for all ferrying equipment.

This is also true of the "Catalina" (PBY Flying Boats), built by Consolidated Aircraft. It was one of these latter ships which discovered the "Bismarck" and led to her destruction. . . . The radio ferrying equipment for both of these planes is produced by Stoddart Aircraft and Sylvania "Lock-Ins" are standard because they can take all the punishment that ferrying planes can give.

Ferrying equipment receives extremely hard abuse because the sets go into planes on the Pacific Coast for use across the country. Then they are removed and shipped back to the Coast to be installed in other planes. They must stand up because there is a minimum of time for the reinstallation and little if any for servicing.

Thus Sylvania "Lock-Ins" are serving in one of the toughest of jobs. No wonder they are selected for tanks, jeeps, fighter planes, transport planes, and ships at sea. No wonder they give such remarkably effective service in motor cars and home radios.

Sylvania Radio Tube Division

HYGRADE SYLVANIA CORPORATION

EMPORIUM, PA.

500 FIFTH AVE., NEW YORK • SALEM, MASS. • ST. MARYS, PA. • IPSWICH, MASS. • TOWANDA, PA.

Also makers of Hygrade Lamp Bulbs, Hygrade Fluorescent Lamps and Miralume Fluorescent Light Fixtures

Introduction

by

DAVID SARNOFF

President, Radio Corporation of America

IN the technique of modern warfare, radio serves the same purpose as the nerves which connect the eyes and muscles of a boxer with his brain. Hitting power and mobility, indispensable to armies, navies and boxers alike, can function only when instant, accurate communications are maintained—communications between fighting or observation units and headquarters, between body and mind.

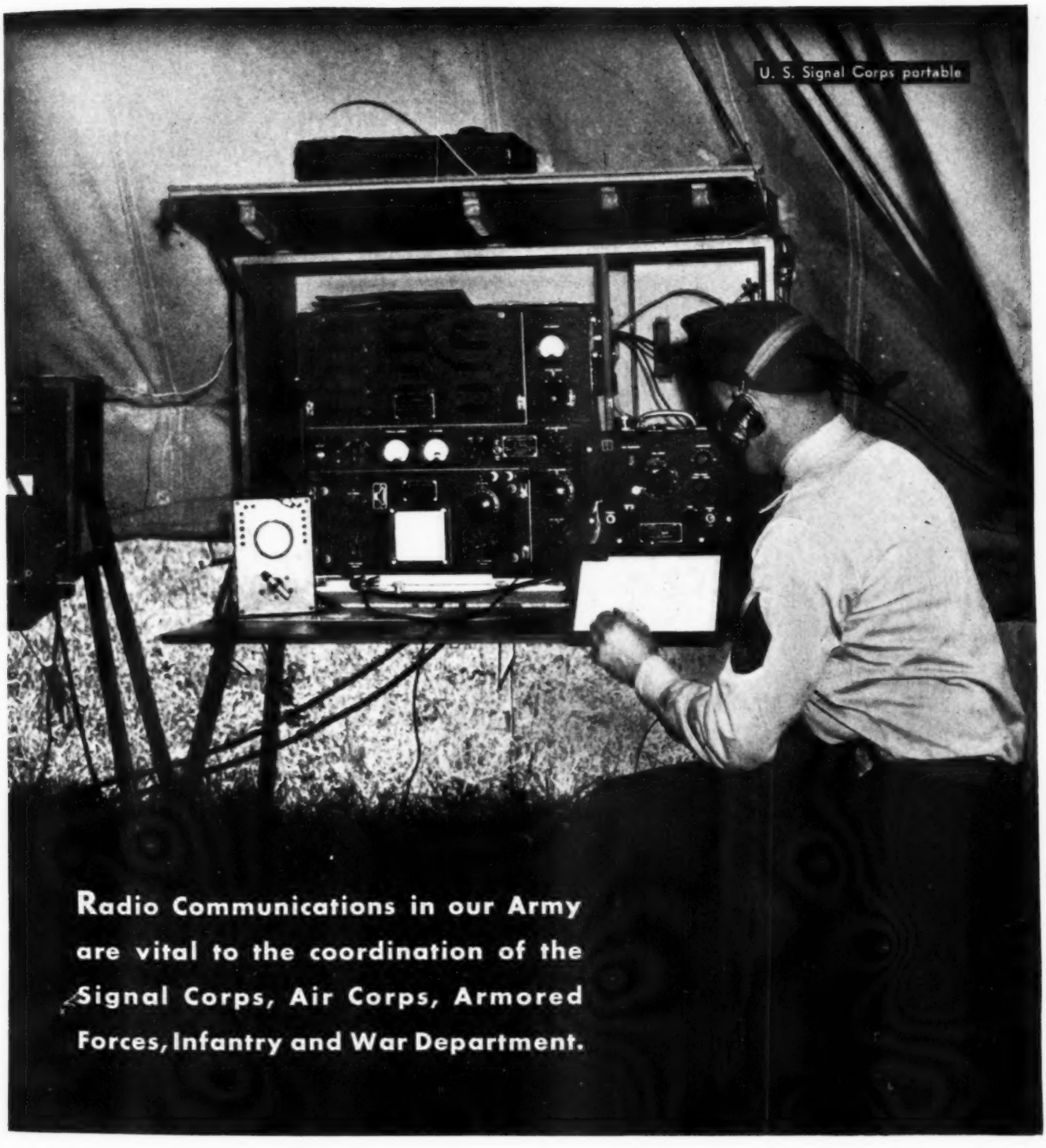
Behind the fighting lines, radio maintains the morale of the people, brings them the voices of their leaders, keeps them informed, warns them of danger.

Radio keeps open the channels of communication between continents and nations, bringing confidence to friends and courage to the oppressed.

"Many months ago, the radio industry of America pledged its best efforts in the interests of national defense. Today those efforts are unreservedly ALL OUT FOR VICTORY."

David Sarnoff

RADIO IN THE ARMY



U. S. Signal Corps portable

Radio Communications in our Army are vital to the coordination of the Signal Corps, Air Corps, Armored Forces, Infantry and War Department.

Major General DAWSON OLMSTEAD

Chief Signal Officer, U. S. Army

Born May 21, 1884, a native Pennsylvanian, was appointed to the United States Military Academy at West Point, New York, in 1902, graduated in 1906 and served a short time with the Cavalry and Field Artillery. He graduated from the Army Signal School in 1909. During the war, he served with the Field Artillery in the Inspector General's Office of the A.E.F. He has held a variety of Signal Corps assignments and now holds the highest post in the U. S. Signal Corps, that of Chief Signal Officer.

★

Radio operators of the Signal Corps using semi-portable field transmitter and receiver.

SIGNAL CORPS RADIO

by Major CHARLES J. McINTYRE

Born May 28, 1895 in Philadelphia. First Commissioned as 2nd Lt. Infantry in the Regular Army. Served in World War I with 4th U. S. Infantry. On return was in command of Co. I, 13th Infantry. Capt. of Infantry, January 1929. Graduate of Fort Benning in 1921, Asst. 93 of 91st Division in Calif. until resignation from Regular Army October 31, 1922. Recalled to active service in Infantry as a Reserve Officer, November 18, 1940. Transferred to Officer Chief Signal Office September 17, 1941.

ALL articles on military matters now-a-days begin with a comparison of the then and now. This is a rather necessary procedure when the horse and buggy method of conducting warfare is contrasted with the modern Panzer wedges, Blitzes, dive bomber attacks and Kessels. Incidentally, Kessel is a German hunting term connoting an encircling operation with the game driven into a central pocket and destroyed. Wedges, like arrow points, are employed in break through operations, speed in the follow through—often with flanks uncovered—by completely mechanized and highly mobile fighting units—all indicate the changing quality of war.

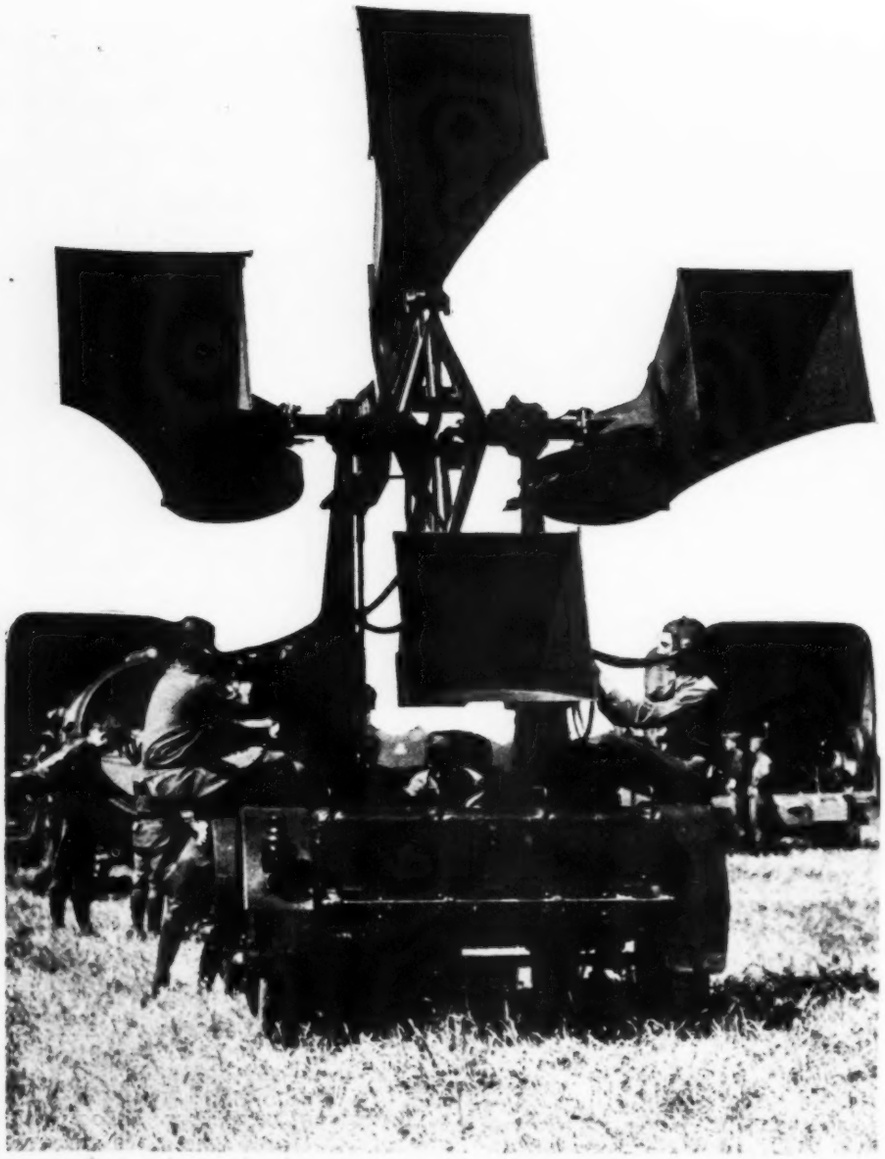
Not only is it now necessary to step up our psychological and imaginative processes from two and a half to forty miles an hour but our tools must be streamlined too. Three inch to-the-mile maps, for example, satisfactory in World War No. 1 must be reduced in scale to make it practicable to follow the progress of mechanized and highly mobile units through a few hours time. Nowhere is this need for streamlining more necessary than in the field of communications. Under the inspiring leadership of Major General Dawson Olmstead, Chief Signal Officer, the *Signal Corps* is finding the solution to this problem.

While it would be most interesting to touch on the imaginative and experimental work on communications now in progress behind the closed doors of the *War Department* and in the various *Signal Corps Schools* and Laboratories throughout the country, our purpose in this article is to show the evolution of the vest pocket edition of the Signal Corps to an encyclopedia and to point out the sign posts, cross roads and highways by which this was accomplished. Often, and especially in the earlier days, bricks were made from straw and the alchemy of leadership furnished and continues to furnish the cement.

Up to the middle of the 19th Century relatively little progress had been made in developing methods and instruments for the systematic exchange of military information although the use of visual signals had been practiced by mariners for centuries.

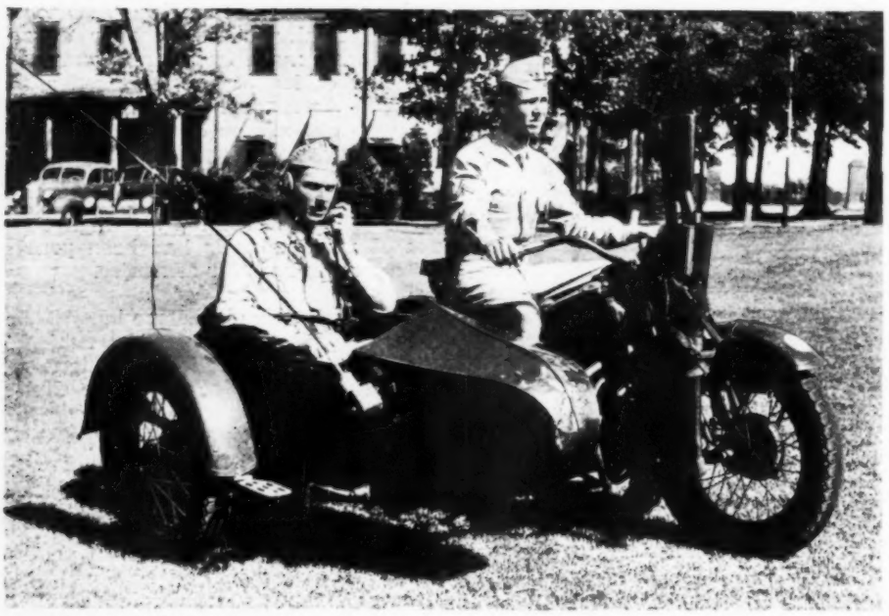
The construction of a practical working telegraph by Morse in 1832-35 turned minds to the general subject of the interchange of ideas by signals. During the years preceding the Civil War, the first steps were made toward the creation of a method of signalling for general use in the *U. S. Army.*

The initiative was taken by a young army officer, Major Albert Myer, and the activities of the *Signal Corps* during the Civil War, and for 15 years thereafter, were mainly inspired and directed under his untiring leadership.



Enemy planes are heard through this radio plane locator equipment.

Speedy radio-equipped scout cars are an important communications link.



Two-man portable field set.

In 1854 his attention had been directed to the desirability of devising a simple method of communication. During his leisure hours at an isolated post in New Mexico he devoted himself to its development. Two years later the *War Department* recognized the possibilities of the system and appointed a board to examine the principles and plans for the use of visual communication in the field.

From this emerged the most well-known of the visual systems, known as the "wig wag" system. In 1859, Secretary of War Floyd commended Major Myer's system to Congress. As a result the *Signal Corps* received its first appropriation. The sum appropriated was $2,000. The same Act authorized the appointment on the staff of the Army of one Signal Officer with the rank, pay, and allowance of a Major of Cavalry.

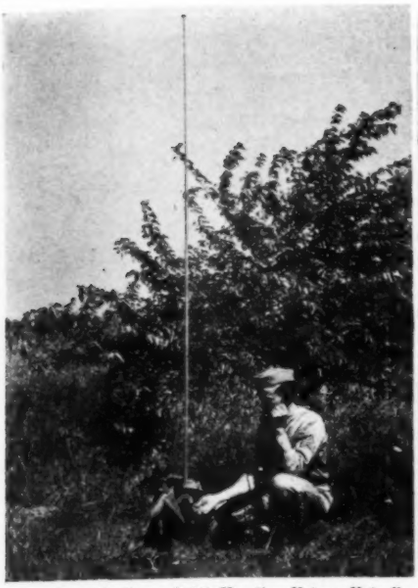
On June 10, 1861, the first signal school was formally opened at Fortress Monroe in Virginia.

Following the Bull Run Campaign, Myer submitted a project for the organization of a separate *Signal Corps* "to have charge of all the telegraph duties in the *Army*."

In his first annual report (November, 1861) Major Myer urged that visual signalling and telegraphy be taught to cadets at the *U. S. Military Academy* and that officers be detailed to each army and army corps to organize and instruct signal parties.

During the year 1862, 199 officers were detailed and instructed as signal officers. Improvement in the *Union Signal Service* in the West became evident. It was the accepted doctrine that signal officers should combine the duties of reconnaissance and signal communications. Experimental work was carried on with rockets, fires, telescopes, signal pistols, discharges, telegraph instruments and insulated wire.

The Act of March 3, 1863, provided for a separate *Signal Corps* during the



The Signal Corps' 28 lb. "walkie-talkie."

Hand-driven motor-generator supplies power to operate this field set-up.

War. In July, 1863, instructions in military signalling began at the *Military Academy* at West Point.

The second Chief Signal Officer was Brigadier General William B. Hazen. His administration was noted principally for the Arctic Expeditions, of which there were several. The most important was the Greely Expedition.

In 1887 General Hazen was succeeded by Brigadier General Adolfus W. Greely, who became the third Chief Signal Officer. General Greely took immediate steps to revive interest in military signalling and to effect improvements in field equipment.

In 1888 a new type of heliograph made its appearance. Heliograph messages were exchanged up to a maximum of 125 miles. With the beginning of the Spanish-American War, the *Signal Corps* had a temporary expansion from its then existing strength to more than thirteen hundred. At the conclusion of the War, the *Signal Corps* found its duties greatly extended in Cuba, the Philippines and Puerto Rico, where telegraph and cable systems were to be constructed.

Through the vision and energy of successive chief signal officers, military aviation was to be introduced into the American Army. In 1908 the first heavier-than-air machine was purchased for the *Signal Corps*. By Act of Congress an *Aviation Section, Signal Corps,* was formed July 18, 1914.

The *Signal Corps* in April, 1917, was composed of 13 officers permanently assigned, 42 of other branches temporarily detailed, and 1,570 enlisted men. This small force was organized into four field signal battalions, and six depot companies. These depot companies existed as organizations for administrative convenience only and had no fixed strength. In addition to the regular organization, the signal troops of our military establishment included units of the *National Guard.*

(*Continued on page* 98)

★

Army field radio may be set up for action in a very few minutes time.

Training students for service in the Signal Corps is supervised by top-notch radio instructors.

TRAINING CENTERS

Many specialized branches are located at the Signal Corps School. Equipment and instruction is the finest.

by Brig. Gen. Geo. L. VAN DEUSEN

Born in Passaic, N. J., on February 10, 1888. Graduated from West Point in 1909. He has served in the Infantry and Coast Artillery, joined the Signal Corps during the World War, spent 7 years as Assist. Commandant, Signal Corps School at Fort Monmouth. A graduate of the Army War College, Navy War College, and Master of Science from Yale University. Awarded a service medal for World War and overseas service. His appointment to the rank of Colonel was made October 1, 1938. Promoted to Brigadier General shortly after April 10, 1941.

OF all countries the United States has shown the greatest development of communications as a factor in civilian life. As a result the *Signal Corps* is fortunate in having a large body of partially trained civilians from which it can draw its personnel. Training men for the *Signal Corps* thus becomes a matter of selecting civilians with the proper backgrounds, training them for the specialties for which they show the most aptitude and assigning them to duties for which they are best suited.

In an article of this length it would be impossible to sketch all of the training activities of this arm of the service which include a vast number of diversified activities from pigeoneering to animating motion pictures. The training program, however, is built around two organizations, the *Signal Corps Replacement Training Center* and the *Signal Corps School.* Together they may be considered a University, the *Training Center* being the College and the Signal Corps School the graduate departments of the University.

The *Signal Corps Replacement Training Center* located at Fort Monmouth, N. J. is, in the Fall of 1941, the only training center for selectees chosen for the *Signal Corps.* Its average strength is 7,000 officers and men who come from all parts of the United States.

During the winter of 1940 and 1941, more than 300 buildings were constructed, including barracks, mess halls, recreation halls, a theater, service club, guest house and utilities at a cost exceeding seven million dollars. Recently, four newly constructed chapels were opened where regular services were held for the several faiths.

In February, 1941, cadres of experienced men drawn from *Signal Corps* units throughout the country were gathered together to form the basic organization of the *Training Center.* The same month the first

Student Radio Operators at Fort Monmouth, home of the Signal Corps School, practicing reception of code.

group of selectees arrived to begin training and from that time on the *Center* expanded rapidly and has been turning out men with basic *Signal Corps* training at regular intervals.

The *Center* is organized into five Signal Training Battalions, a Headquarters Company and a Consolidated Mess Company. These training battalions serve as the organizational home of the men during their stay at Fort Monmouth, although the actual training in specialties is conducted in schools set up for that purpose.

At the Reception Centers throughout the country, certain men are chosen for *Signal Corps* work on a basis of their previous experience and special qualifications. They are then sent to the *Replacement Training Center* where various aptitude tests are given to further determine the exact type of work best suited to the individual.

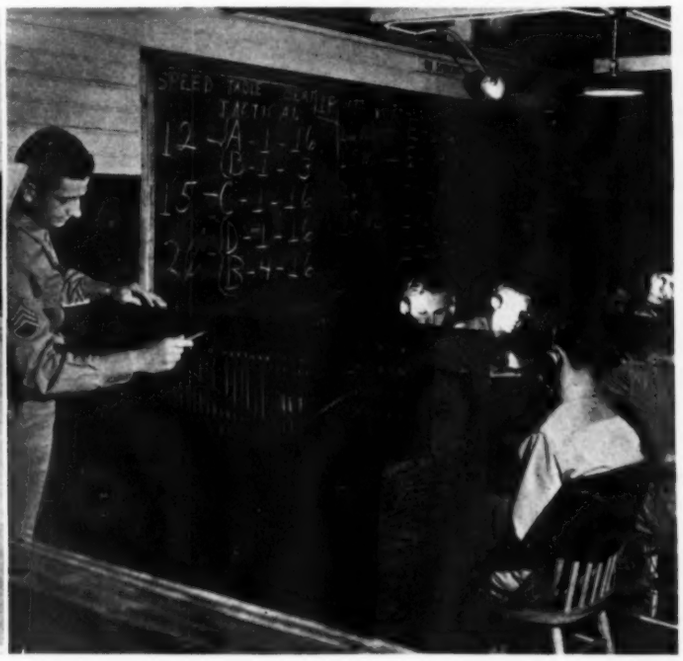
Before actual training in the specialty is started, the men are required to attend a two-weeks' course in the Basic School. The subjects taught are those considered necessary for every soldier before he is given specialized instruction and include military courtesy, discipline, drill, pistol marksmanship, defense against chemical warfare, army organization, personal hygiene, and the making of a field pack.

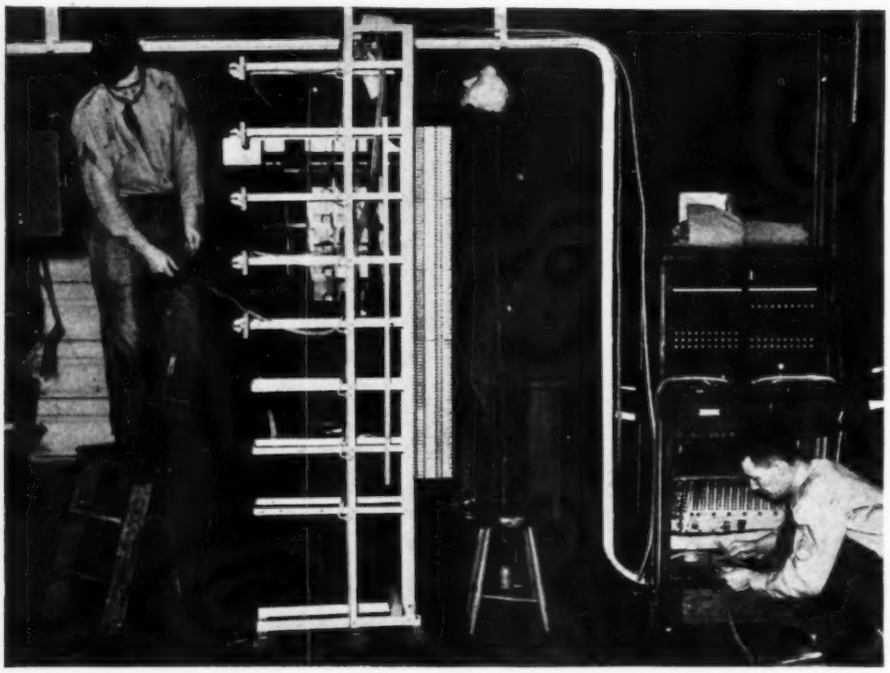
Having completed their recruit training, the men are sent to one of the specialty schools which include the Wire School, the Message Center School, the Radio School, the Cook's School, the Auto Mechanic's School, the Clerk's School, the Chauffeur's School and a school of miscellaneous specialties which include cryptography, photography, typing, and teletype printer operation.

At the completion of their training the selectees are ready for assignment to *Signal Corps* Units throughout the country and are replaced by a new group of selectees who will go through the similar courses of training.

The *Signal Corps School* also located at Fort Monmouth, is one of the service schools maintained by the

Lower left: Students marching to their classes. Lower right: Instructor selects proper tape and speed.





Students learning Wire-Installing at the Signal School, Ft. Monmouth, N. J.

various branches of the Army for advanced specialized training for officers and men.

Fifteen percent of the Selective Service soldiers sent to the *Replacement Center* are chosen as a result of examinations and personal interview and detailed for advanced specialist training to the *Signal Corps School.* The other students of the School, both officers and men, come from all parts of the United States and its possessions.

The staff of the *Signal Corps School* includes the Commandant, who also commands Fort Monmouth, the Assistant Commandant, who is in direct charge of the instruction and administration of the school, the Secretary and the directors of the departments. The school is divided into the following departments; Officers, Officer Candidate, Enlisted Men, Aircraft Warning and Training Literature.

To represent their respective branches in a liaison capacity, one infantry officer, one cavalry officer, one field artillery officer and one Marine Corps officer are assigned to the school by the *War Department.* These officers also assist the Officers' Department by instructing in such phases of signal communication tactics and technique as pertain to their own arm.

The Officers' Department conducts three-months' courses for Company officers of the *Army* and *Marine Corps.* The course of study is designed to qualify all officers for duty in field organizations and give them a general knowledge of the organization and tactics of various branches of the Army, to include field armies, and, also to train them in one of the five communication specialties. Upon completion of the course officers are assigned to the duties for which they have shown the most aptitude.

The first of three-month courses in the *Officers' Candidate Department* began in July, 1941, with a student body of 500 chosen from warrant officers and enlisted men of the Army. Commissions as Second Lieutenant in the Army of the United States are given to those who successfully complete the courses. Selection of the candidates to attend the school is made under the supervision of the Adjutant General by Corps Area and Department Commanders from enlisted men and warrant officers with previous federal service.

The basic considerations governing the selection of students is leadership, as demonstrated by actual service and communications knowledge. Corps Area and Department Commanders may assure themselves in any manner they consider appropriate that the applicant possesses the intelligence necessary for a commission as an officer.

The courses of training are similar to those given in the *Reserve Officers Training Corps* and include Military Organization, Drill, Marksmanship, Map Reading, Supply, Administration, Training Methods and Customs of the Service.

The Enlisted Men's Department is organized under a director and is subdivided into a *Radio and Wire Communication Division,* each of which has its officer-in-charge, commissioned assistants, and staff of enlisted instructors. Most of the latter are non-commissioned officers of staff grade, who in addition to being graduates of the *Signal Corps School,* have had commercial and field communications experience. The student enrollment averages 1700 with about half assigned to each division. Between 6500 and 7000 men will receive training by the end of 1941.

The *Enlisted Men's Department* receives its students from the *Signal Corps Replacement Training Center* at Fort Monmouth and from the Regular Armed Forces. The selection of men from the *Signal Corps Replacement Training Center* is based on the results of individual ratings in the Army General Classification Test and the General Electrical Information Test, as well as personal interviews concerning civilian experience and proficiency in prescribed specialties. Enlisted men, detailed for training from tactical units, are carried on detached service by the home organization to which they will return upon the completion of training. These are soldiers who have been recommended by their immediate commanding officers, and who have successfully passed

Modern facsimile transmitters and receivers are available for study.

entrance examinations prescribed by the Chief Signal Officer. Selected personnel of the *Marine Corps* and *Coast Guard* are also detailed for this training. Courses require three or four months for completion, depending upon the specialty pursued upon entering the school.

The *Radio Division* offers training in two principal specialties, radio repair and maintenance, and fixed station radio operation. A few men are also trained, however, as radio operators, field station, and as telegraph printer operators. The radio maintenance course embraces a thorough subcourse in radio theory, "Elements of Radio," followed by a month's training in the actual testing and repairing of Signal Corps Field Equipment. The laboratory equipment available is of the latest commercial design. The students gradually become adept in the handling of test instruments, in locating such troubles as may develop in field radio equipment, and in properly servicing such equipment.

The fixed station radio operators' course is open only to those men who have already attained a receiving speed of fifteen words per minute in the International Morse Alphabet. The student is taught the art of touch typing, and soon learns to copy on the typewriter. By constant practice his receiving speed is increased to thirty-five words per minute, or more, a speed which he must attain in order to qualify for his certificate. He is also taught how to use the high-speed transmitting key the "bug," and how to read messages from ink-recorded tape, transcribing them on the typewriter. The fixed station radio operator learns the type of procedure known as "War Department Procedure," which differs little from that employed in handling commercial radio traffic.

The *Wire Division* gives courses in a number of specialties covering practically the entire field of telephone plant crafts. Approximately half of the students in this division receive training as "installer - repairmen," mainly for local battery installations, which are of a semi-permanent nature. Installer repairmen, local battery, after receiving the basic course in the fundamentals of electricity, are given subcourses in local battery telephone and switchboard circuits, technique of field wire systems, and the repair of field wire equipment. Installer repairmen, common battery, instead of receiving instruction in field wire equipment are taught the details of substation installation and maintenance, and are given a subcourse in common battery line and subset circuits.

The next largest class comprises the "Wire Chiefs," who are the men who supervise the maintenance of wire communication systems. This specialty is subdivided into local battery and common battery work. Wire Chiefs, local battery, receive training not only in field telephone circuits, but in field telegraph circuits. Wire Chiefs, common battery, are trained not only in the theory and practice of common battery and switchboard circuits, but also in Central Office installation and maintenance, and in cable maintenance. There are also courses for switchboard-installers and cable-splicers. About eighty men in the *Wire Division* are enrolled in the telegraph printer "teletype" maintenance course.

Students receiving telegraph code. Morse sounders are enclosed in boxes.

This type of work requires individuals who have considerable inherent mechanical aptitude. In this course, the students learn to disassemble, reassemble and readjust the entire telegraph printer mechanism, and to correct one hundred and twenty cases of trouble on the machine. There are other subcourses available, for example, Pole Line Construction is taught to men enrolled in the cable splicing course and in the Linemen's course.

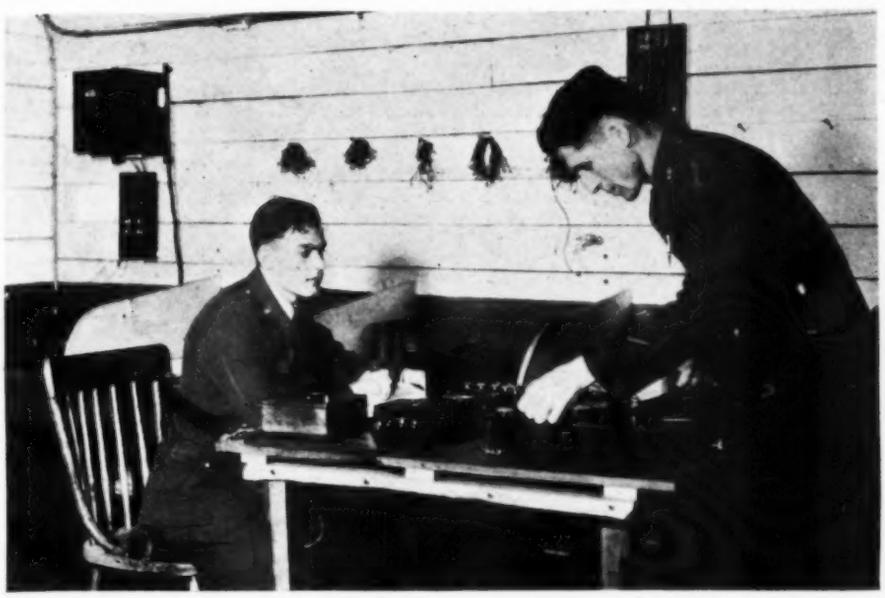
Framemen and Insidemen are two additional types of personnel trained in the Wire Division. They receive instruction in central office maintenance, as well as in common battery line and switchboard circuits.

All of the students in the Enlisted Men's Department, with the exception of those enrolled as cable splicers and line foremen, or fixed station radio operators, are required to take a basic subcourse in the principles of electricity and magnetism. This is followed by a short course in basic shop work. As a means of assisting the men who will later be instructors in field units, a course in Teaching Methods is prescribed for all non-commissioned officer students from Regular Army Units.

The self instruction method is employed in the Enlisted Men's Department and has been found most satis-

(*Continued on page* 76)

Studying electrical circuits. Note flexible test leads hanging on wall.



Entrance to main building, Signal Corps Laboratories, Fort Monmouth, New Jersey.

RADIO LABORATORY

The Signal Corps Radio Laboratory consists of several divisions. Each one specializes in important subjects.

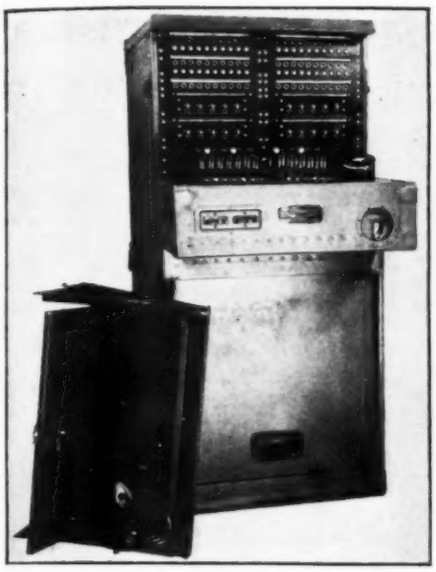
by Major R. V. D. CORPUT

Born in Atlanta, Ga., on September 28, 1900. He entered the U. S. Military Academy in 1918, graduated in 1920 and was commissioned a Second Lieutenant in the Field Artillery. Graduated from the Field Artillery School in August 1921. In 1925 he was promoted to First Lieutenant. In 1929 he was transferred to the Signal Corps. Promoted to grade of Captain in 1935. Graduated from the Signal Corps School in 1936 and was assigned to the Signal Corps Lab. His promotion to Major occurred in 1940.

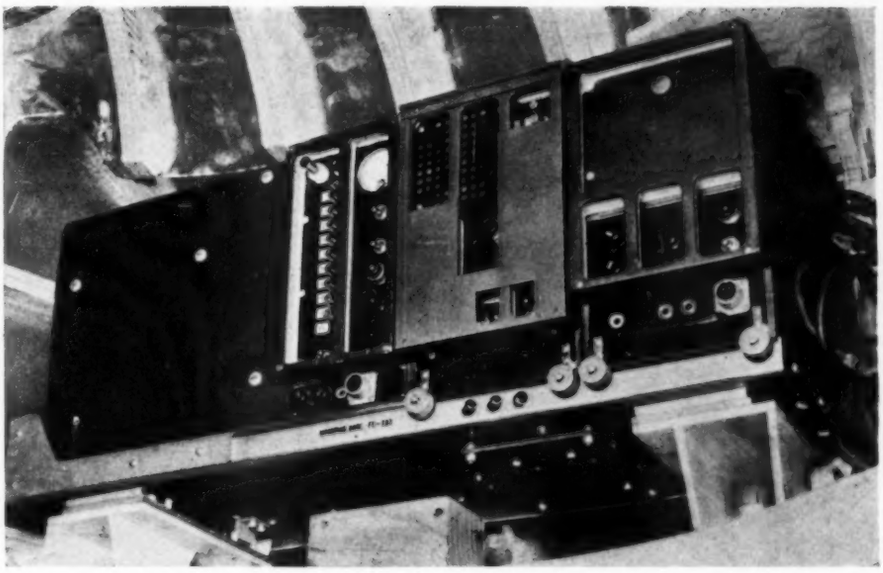
THE *Signal Corps Laboratories*, located at Fort Monmouth, N. J., approximately thirty-five miles south of New York City, had its origin in the late Fall of 1917 during World War I, at which time the *Laboratories* was concerned with the development of radio only. During the intervening years all *Signal Corps* development work except that pertaining to aircraft has been concentrated at the *Signal Corps Laboratories*. The policy of the *Signal Corps* in connection with the *Laboratories* has been: first, to maintain a complete development and specification staff; and second, insofar as practicable to procure development from outside agencies rather than to develop the equipment within the *Signal Corps Laboratories* solely. During peacetime this resulted in about 25% of the development work being done by *Laboratories* personnel, about 25% being done entirely under contract with commercial concerns and the remaining 50% by close collaboration between the *Laboratories* and industry.

At the beginning of World War II, with its threat to the democratic form of government, it was apparent to the President of the United States and to Congress that immediate action was necessary to properly arm our country for any and all eventualities. The personnel of the land, sea, and air forces were immediately expanded through enlistments and conscription; necessitating the supplying of these armed forces with adequate equipment. The tempo of the *Laboratories* research and development was increased to the maximum to accommodate this demand, the *Laboratories* having been expanded in the past year and a half from some 200 employees to approximately 2000 employees with necessary further expansion still going on.

Fortunately the close association of the *Laboratories* with industry during



Laboratory Office Switchboard.



Typical installation of communications equipment in mechanized unit.

times of peace enables the *Signal Corps* to take immediate advantage of all the facilities for development in the United States so that during the past year and a half approximately 90% of all development projects have been carried out by contract with industrial organizations. Also, fortunately, the retention during times of peace of the complete working staff of the *Laboratories* has enabled them to coordinate the work of these industrial concerns with the result that substantially all ground radio communication equipment and much wire equipment which was standard at the beginning of the present emergency is now being superseded by newly developed equipment. The *Laboratories* are organized as follows:

Director—Major, U. S. Army
Project officers—Commissioned Officers, U. S. Army
Operating research and development personnel—Civil Service Employees

The *Administrative Section,* through its various subsections, handles the incoming and outgoing mail, filing of engineering reports and project records, the message center, the information bureau and guards, the fiscal and cost accounting, personnel, offset reproduction, and the maintenance of a complete technical library on radio subjects.

The *Product Engineering Section* is set up for the purpose of investigating and testing materials used in *Signal Corps* equipment, to carry out the refinement and the production inspection of standardized *Signal Corps* equipment and to prepare the necessary drawings, blueprints, and specifications for procurement purposes. Standardized *Signal Corps* equipment includes those items that have been carried through the developmental stage by the various research and development sections and have been approved by the field forces of the army during service tests.

The *Specification and Record Section,* a subsection of the *Product Engineering Section,* has the task of writing the procurement specifications and supervision of the drawings after the equipment has left the development section. This group is charged with the responsibility of maintaining files of drawings, blueprints, specifications, and nomenclatures and to see that the drawings and specifications are revised and brought up to date as may be necessary.

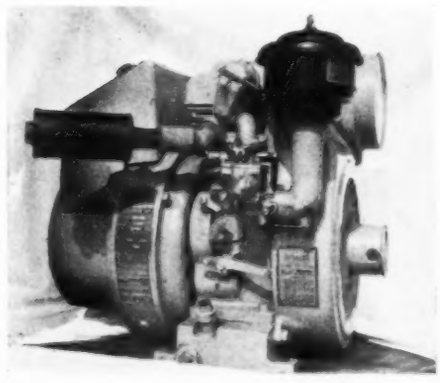
The *Inspection Engineering Section,* a subsection of the *Product Engineering Section,* is divided into two groups. One group handles the inspection of samples and sample components as submitted by the *Signal Corps* contractors. To this group falls the responsibility of inspection and approval of such items as condensers, resistors, transformers, switches, meters, and other components to determine if these parts submitted comply with the electrical and mechanical requirements as set forth by the contractural specification. All correspondence sent to the *Signal Corps Laboratories* requesting approval as to certain technical details of components pertaining to the particular contract, is handled by this section. The second group of this subsection handles the modernizing and refining of existing standard equipment. Necessary changes in existing equipment required to keep step with the rapidly changing military requirements of modern warfare are accomplished by this section.

The *Procurement Division* has set up an efficient machine for the handling of contracts for the procurement of service-test models and also for supplying the needs of the developmental sections with adequate material.

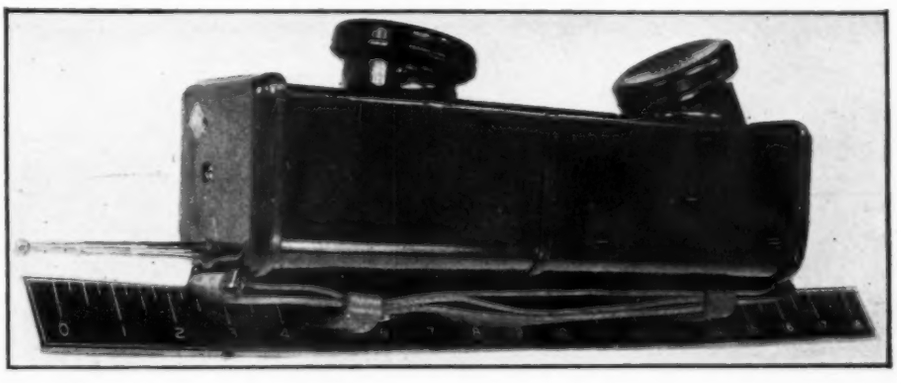
In the maintenance and operation of a large organization and the subse-

(*Continued on page* 100)

Emergency plant for field use.



Ultra-compact radio transceiver developed in the Signal Corps Labs.

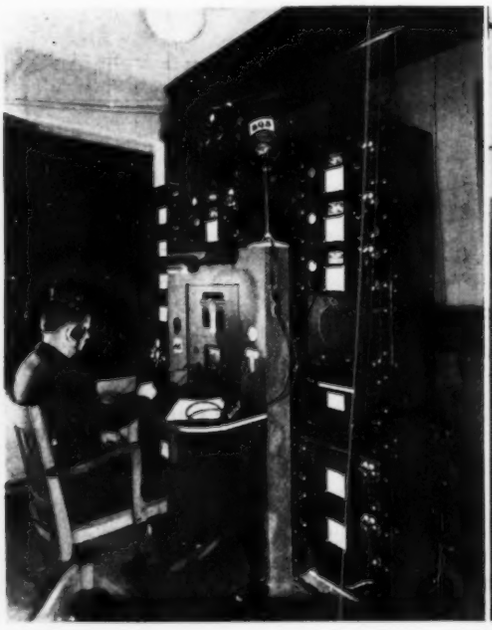


RADIO IN THE

Vultee BT-15's in formation. Note the vertical radio antenna on each plane.

The safety of aircraft is dependent upon the efficiency of the communication system and the many radio aids to navigation. Close coordination between planes and ground units is essential to maximum efficiency.

Missouri National Guard station.



Up-to-date Airdrome Control Position WYC, Langley Field, Virginia.

ARMY AIR CORPS

by CAPTAIN AARON R. ANTHONY

Born in Reading, Pennsylvania, August 1, 1907. Attended various Eastern engineering schools. Radio engineer and mechanical designer. Associated with the Civil Aeronautics Administration before being assigned to duty with the Air Corps. Associate member of the Institute of Radio Engineers. On duty with the Communications Section of the Training and Operations Division and is now stationed in the Office of the Chief of the Air Corps.

THE use of radio in military aviation engulfs a wide and varied system of communication between the various components of the *Air Forces* of our expanding Army. Radio communication in the *Air Forces* is not entirely confined to the movement and tactical operation of military aircraft. Radio as a means of communication is the ultimate solution to coördination between the ground headquarters and aircraft in flight.

The optimum safety is a major factor in the operation of aircraft, and this safety is dependent upon the efficiency of the communication system and the radio aids to air navigation. The efficacy of an observation or bombing mission is as good as its communication facilities, because without these facilities the effort is practically wasted inasmuch as there are no other means of communication from air-to-ground over any great distance.

Modern warfare demands that immediate action is essential and in order to coördinate the combat elements on the ground, in the air and on the sea, a super-modern communication net is required. The modern system of warfare is practically impossible without the use of radio.

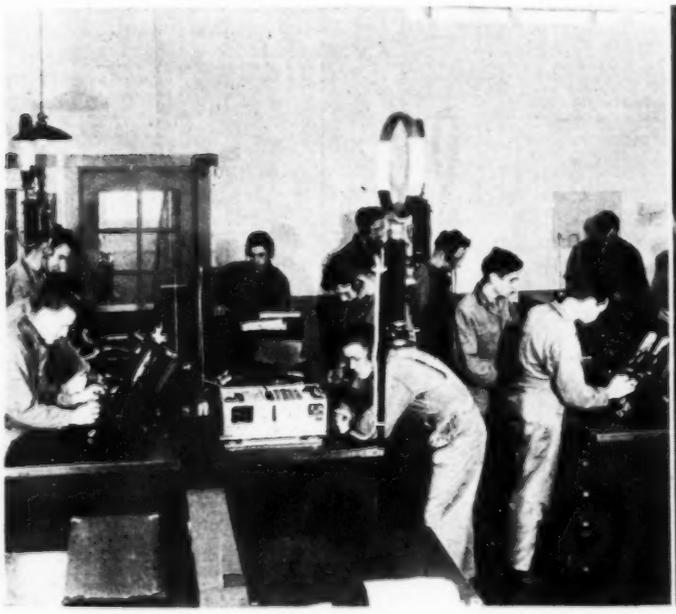
In aerial warfare, communications assume a more prominent part than in ground combat due to the tremendous speeds which have been attained by military aircraft, and the fact that a fighting plane must strike its blow and then return to its base in order to refuel and replenish its ammunition makes the time element a very important factor.

One of the largest communications organizations of the *Air Forces* is the *Army Airways Communications System,* an ever expanding net of radio communications whose purpose is to expedite the movement of military aircraft safely from one strategic locality to another. This branch of communications operates under the direction of the Chief of the *Air Corps.* A network of radio stations has been constructed for the dissemination of weather information to aircraft in flight and a system of radio range stations and radio marker beacons in the vicinity of Army air fields. In addition, it operates an extensive system of point-to-point radio stations for the transmission of reports on the progress of aircraft en route along the Army Airways. The *Army Airways Communications System* compares somewhat with the *Civil Aeronautics Administration's* airway traffic control system.

With this organization lies the responsibility for reporting movements of aircraft, the operation of the airdrome control towers, the transmission of weather reports, and the operation of the Army radio ranges. A typical *Army Airways Communications System* station consists of either a 200- or a 400-watt transmitter and seven receivers of the commercial type, each one guarding a predetermined frequency. The transmitters are used for airways point-to-point transmission and ground-to-air transmission. These are ten-channel transmitters operating with a frequency range from 2,000 kilocycles to 16,100 kilocycles with A-1, A-2 and A-3 emission employing the short wave vertical type of antenna and having a daytime range of 300- to 500-mile operating radius.

Some of the outlying *Air Corps* stations are to be provided with a 3-kilowatt ten-channel transmitter with a

Air Corps Technical School shop, Chanute Field, Illinois.



Students getting instruction on modern aircraft radio.

Pilots must keep in very close contact with flight commander.

frequency range of 4,000 to 20,000 kilocycles, A-1, A-2 and A-3 emission with an 800- to 1,200-mile daytime operating radius.

The control tower at an Army airport is a beehive of activity with planes coming in for landings; others taking off on tactical missions or training flights continuously. The facility is responsible for the control of air traffic in the vicinity of Army airdromes where air traffic is congested. The airdrome control radio equipment consists of a 25-watt transmitter operating on a frequency of 200 to 400 kilocycles. Four commercial type receivers are used to guard the frequencies employed by the various types of military aircraft in contacting the airdrome control tower.

Practically all *Air Corps* stations are provided with low power radio ranges, sometimes referred to as localizer ranges. This nomenclature is derived from the fact that these ranges are orientated so that one leg of the range coincides with the longest runway on the field. The ranges are used in conjunction with navigation and orientation problems carried out in close proximity to the air field. For cross country flights along the civil airways, the facilities of the *Civil Aeronautics Administration* are used.

Radio ranges at most *Air Corps* stations are of the aural type operating with a power output of 100 watts and are keyed to transmit A (. —) and N (— .) code signals. The space pattern of the range station is formed by the interaction of the two figure-of-eight patterns, which may be distorted to align the resulting equi-signal zones or "courses" with the airway routes or airdrome runways. The pilot follows the radio range courses by manipulating his airplane so that the "A" and "N" signals come in with equal strength and merge into a continuous long dash or monotone indicating he is "on course." At periodic intervals, usually twelve seconds, the monotone is interrupted by the automatic transmission of an identifying signal which tells the pilot which radio range he is hearing.

The range station is usually located approximately three to five miles from the airdrome, on a prolongation of the longest runway, in order that the towers comprising the antenna system will not be a menace to flying operations and at the same time facilitate the approach of an airplane to the field for a landing under adverse weather conditions. The transmitters of this range are operated by remote control from the radio communications station or the airdrome control tower at the flying field.

Usually a radio marker beacon is provided at each radio range station. These marker beacons operate on a frequency of 75 megacycles and provide a cone of signal radiated vertically upward. This cone of signal coincides with the cone of silence (the zero signal zone directly over the range towers) of the radio range and is used for the same purpose, namely, to indicate to the pilot that he is passing over the station. The cone of signal provides a more positive type of indicator for orientation purposes inasmuch as it activates a light on the instrument panel of the plane.

We have covered to some extent the ground component of this communications system. The efficiency of communications between aircraft and the ground is somewhat hampered by the necessity of using compact and lightweight equipment. The average bombardment type of aircraft carries what is known as a command set, which is used for interplane communication in a formation, contacting airports, and for use in conjunction with air navigation; a liaison set operated by the crew radioman in contacting *Army Airways Communications System* and *Civil Aeronautics Administration* stations and giving position reports, obtaining weather reports and contacting squadron or group radio stations.

In order that the pilot, navigator, or radio operator may check his position, a radio compass is provided. Probably the smallest piece of radio equipment in use on these planes is the marker-beacon receiver used to determine when a plane is directly over a radio range station or fan marker and is also used in conjunction with certain types of instrument landing systems. The small type of aircraft such as the pursuit fighter does not carry as elaborate radio equipment as a bomber due to the necessity of conserving weight which is utilized for ordnance equipment or to increase the speed of the plane.

Weather reports being another extremely important factor in flying are compiled in part from information transmitted to the weather station from an altitude of approximately fifteen miles. At certain weather stations radiosonde observations of the upper atmosphere are made. This operation is accomplished through the use of delicate radio equipment. A small radio sending set weighing only a pound and a half and containing simplified instruments is attached to a six-foot balloon filled with helium or hydrogen. The balloon is allowed to rise of its own accord carrying the radio equipment which immediately begins to broadcast to a receiver in the weather station the conditions of the atmosphere found through effects on the enclosed instruments. Changing pressure temperatures and varying amounts of moisture in the air are thus recorded. The balloon ascends to an altitude of about 70,000 feet where it has reached a diameter of 25 feet, whereupon it bursts and the radio falls slowly to earth attached to a parachute. The address of the weather station is attached and the finder upon returning the minute radio receives $5.00 from Uncle Sam.

The radio transmitter used in this radiosonde equipment employs a double triode electron transmitter tube in a push-pull tuned oscillator circuit and operates on a fixed frequency of 68 megacycles. This frequency is high enough to eliminate interference on the radio spectrum. A trailing antenna about 7 feet long is used in conjunction with the transmitter. In transmitting the temperature, a capillary filled with a special electrolytic introduces a resistance in the radio

circuit as the temperature falls. For humidity, a special unit of human hair actuates a mechanical resistance as moisture increases or decreases. In transmitting the pressure, the registering unit is an evacuated, specially-sealed diaphragm with a pointer attached for closing circuits across a contact segment. The ground receiving equipment utilizes a di-pole antenna connected to the receiver by a coaxial transmission line feeding a receiver of special design for short-wave reception. The varying audio frequencies audible by earphones, or visually shown on the dial on an electronic frequency meter, are received continuously by this special short-wave receiver, and are fed into a high-speed photoelectric recorder. Though interpreted as audio frequency, the electric output has been converted into a pulsating direct current, and as it passes into the recorder, it is metered by a microammeter. The varying deflections of the indication pointer of the microammeter interrupts a light beam. A graph is thereby executed on a moving chart by the tapping of a bar on a typewriter ribbon caused by interruptions of the beam.

The radio net used for tactical communication in the *Air Forces* is under the control of the *Air Force Combat Command,* which is responsible for the tactical operation of the fighting *Air Forces.* This net is a closely woven system of communication between the various air commands and the coördination of air-ground operations, such as communication between an observation or bombardment unit and a unit of the *Armored Forces.*

The major elements involved in the effective operation of these various *Air Forces* communication facilities are the development and maintenance of equipment and the vital factor of trained personnel.

First, the development shall be considered. *Wright Field,* located just outside of Dayton, Ohio, is the home of the aircraft radio laboratories operated jointly by the *Air Corps* and *Signal Corps,* which also maintains a development and research laboratory at Fort Monmouth, New Jersey. The two main units are the *Air Navigation* unit and the *Communications* unit assisted by other subordinate units. The communications unit is charged with the responsibility of developing and increasing the efficiency of radio transmitters, receivers and antennas used for air to ground communication.

Development work is being carried on continuously on the following projects: Radio landing systems, the radio direction finder; means for the prevention of collision between aircraft which are flying on instruments; automatic radio control of aircraft, etc.

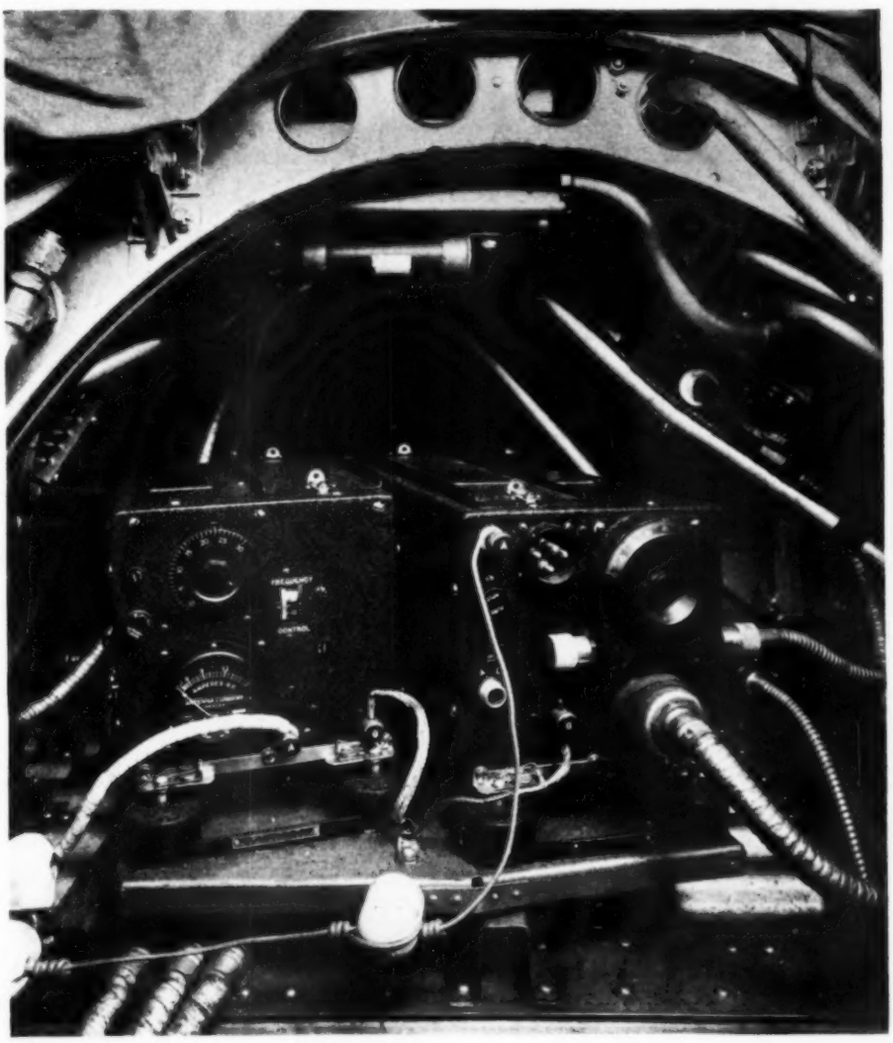
The *Army Air Corps* is one of the many governmental organizations involved in the development and experimentation in the field of instrument-landing systems. The fundamental requirement of an instrument-landing

(*Continued on page* 111)

Ready at all times for duty is the radio-equipped ambulance. These are stationed at every field and are manned by men who are highly trained.

★ ★

Radio installation in Martin B-10B. Note how each unit is shock-mounted to safeguard the radio equipment from constant vibration of the plane.



Portable transmitter-receiver gets its power from a hand operated generator. This set has loop antenna.

RADIO in the INFANTRY

In sharp contrast to the older methods of communication is the radio. The Infantry has been equipped with all of the latest types in sufficient quantity for their needs.

WE DO not usually look to Mother Goose for light on the military art but the old girl seems to have crammed much of it in a nutshell in an old nursery jingle.

"For the want of a nail the shoe was lost,
For the want of the shoe the horse was lost,
For the want of the horse the rider was lost,
For the want of the rider the battle was lost."

It does not take any very profound strategist to see that the only place in war where the absence of such a trifle as a nail could entail such catastrophic consequences is in the communications system. I can not picture this unfortunate rider as other than the bearer of a message containing vital military information or a crucial military order. The non-delivery of that message meant a vital movement which did not take place, a passing opportunity lost and a fatal hostile blow which was not countered in due time.

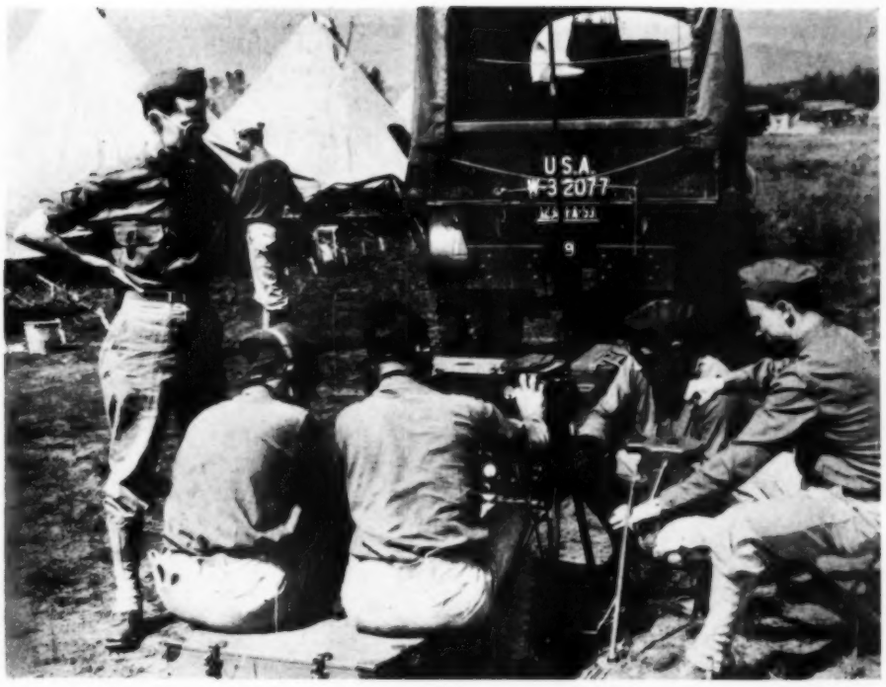
Similar failures produce similar consequences today. A military commander without information has a value somewhat less that zero, and the best army in the world with the best commanders, but without the means of transmitting orders, is not even a mob. It is just a thick smear of protoplasm on the landscape.

Of course no army has ever found itself quite as badly off as that. In the good old days not so long gone when military operations were of the reasonable and comfortable kind based upon the powers and limitations of biped and quadruped animals, communication requirements were simple. You sent a message or you went, yourself, to the required place, received the information and gave the necessary orders. There was at least an even chance that you got into action in time because the enemy's communications were like yours and enemy horseshoe nails were just as apt to be lost. The more resourceful supplemented their other means with visual signalling of various kinds and gained, undoubtedly, a great advantage; but the backbone of it all was the man carried by his own feet or by those of a horse. Special equipment and technically trained communications personnel were alike absent and unnecessary.

As far as military tactics is concerned, that leisurely age endured until very recently; for tactics is the art of handling troops on the battlefield in the presence of the enemy, and in that field the great advances of a century or so ago, represented by the railroad and the telegraph, found surprisingly little application. They couldn't be made available just where and when needed on the battlefield. Some adaptation of wire communications to tactics in the broad sense was introduced about the time of the American Civil War, but upon the local scene the messenger and the dashing aide-de-camp still reigned supreme.

Since then the *Signal Corps* of the Army has done splendid work in modi-

The "walkie-talkie" is ideally suited to transmit commands over short range.



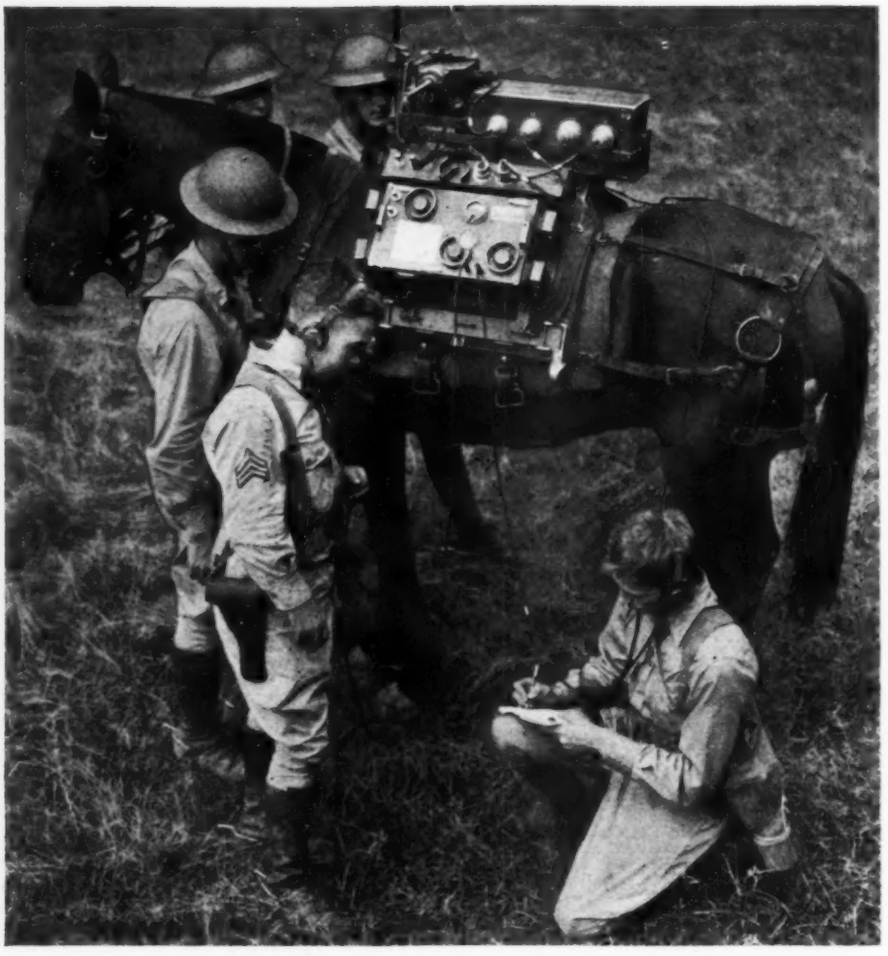
The Infantry uses several types of radio transmitters and receivers. Signal Corps operators are shown with one of the self-powered units.

fying both the telegraph and the telephone to mobile use in the field, and other armies have done the same. Portable instruments and field wire had taken much of the total weight off the messenger's feet. In a few hours the prospective battlefield could be covered with a network of communications and the "slashing, dashing doughboy" had to move fast, indeed, to outrun his communications.

Radio came. At first it was crude, cumbersome and unreliable. Gradually short range portable radio transmitting and receiving sets were developed which could be carried on the backs of men and set up at the various command posts. They often worked, too, and constituted a valuable auxiliary of the other signal communication means. They were regarded strictly as auxiliary and emergency means. It was fun to watch the radio operators in those days. Painstakingly they set up their equipment and twirled their dials. Then commenced the game of hide-and-seek through the "ether ways," the operators crouched over their keys alternately sending out the "dit-dit-dah-dit" of the various station calls and, in between, listening with the raptness of a religious devotee. When—and if—they established communication the light in their eyes was beautiful to see. Sometimes—but not often—they beat the field telephone to it and their joy was complete, albeit often short lived for something usually went wrong. But why worry? The communications system was amply fast for the type of operations involved in infantry combat. The electric current and the radio wave could spot the trudging foot soldier a generous margin and still beat him to the finish. Yes, signal communication in the Infantry was very satisfactory.

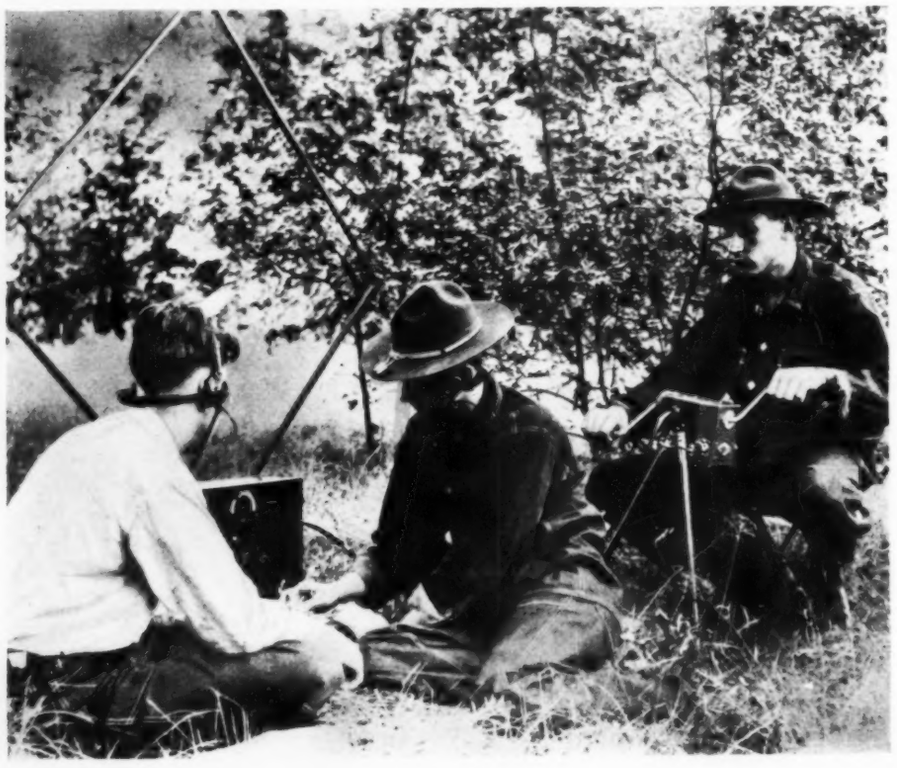
Under the support of the Artillery, the 13th Infantry soldiers go into action against the opposing enemy. These men belong to the First Army.

A group of officers and operators of the 107th Cavalry Regiment at the recent Maneuvers in Arkansas. Equipment is carried on horseback.



Soldiers of Troop B sending and receiving messages on portable pack radio. It has a range of some 50 miles and the overall weight is about 175 pounds.

Many of the field radio sets are designed especially for operation with loop antennae. This one is powered with a hand-driven motor-generator set.



And then, almost simultaneously, came the modern aeroplane, the fast tank and the powerful cross-country motor vehicle.

Our American Army not only knew about these things; we actually led others in their design and development, but we just weren't spending the money to get them in quantity. Meanwhile the tempo of infantry combat had changed from a few miles per day to scores of miles per day. The depth of the tactical zone traversed by the Infantry in a day increased from a few miles to scores of miles. The time taken by the erstwhile plodding doughboy in the development for an entry into combat was phenomenally cut, and the speed and flexibility in the establishment of communications which had previously seemed so generously ample suddenly became inadequate. The troops moved faster than they could be controlled, and the directing brain, minus adequate sensory and motor nerves, could not exert its influence when needed. The horse-shoe nail was, apparently, missing. That was less than two years ago.

There is no denying that, in a physical sense, this sudden transition caught the *Infantry* more or less flat footed. I say "in a physical sense" because the communications equipment physically available, even in the Regular Army, had suddenly become obsolete and inadequate. This does not mean, however, that those responsible for the efficiency of the *Infantry* had been sitting idly by. It only means that development in the field of automotive engineering and production and its adaptation to military purposes had taken a sudden spurt which left development in other fields, particularly in signal communications, trailing by several lengths.

This may seem like a strange statement, considering the extent to which radio pervades everything and every place today in civil life, but when you stop to think that, great as has been the development, its principal manifestation has been in the increasing number, size and power of fixed transmitter installations, the prolixity and diversity of broadcast programs, and the refinements and variations in household receiving sets in the broadcast field, we begin to see light.

From the enormous installations used to amuse the broadcast audience of the country or to communicate across the seas to the portable and flexible equipment required on the battlefield there is a very wide gulf, and, until the present expansion of National Defense lent urgency, the incentive in the commercial world towards developing radio equipment whose usefulness seemed restricted to the battlefield was practically nil. And there was the rub.

Popular impressions to the contrary notwithstanding modern radio equipment does not spring full fledged and perfect from the mighty brain of some brilliant individual into quantity

production. Electricity and magnetism, the twin sisters which are radio, although themselves without weight, bulk or substance, are disgustingly choosey about the form, size and materials of the harness in which they work. They insist upon plenty of heavy metal. They demand privacy and squabble like the members of a committee if too closely confined. If all the stairways and corridors of their play house are not of the design they like, they stray and raise the devil. They just won't play nice except with that other set of twins, "Weight and Bulk."

I know this statement will bring pitying smiles to the faces of devotees of Buck Rogers and the Sunday supplements; but, unless somebody has been treating me to a superb job of kidding for many years, those are the facts and they constitute the reasons why, today, the military commander in the field has more of a problem in handling his team than the quarterback of a football team. It is harder to get the signals through.

Maybe that allusion to the football team was unfortunate. It might tend to create the impression that the simple, one-link chain of control that works well for eleven men in a huddle can be duplicated with combat teams of different sizes up to those consisting of hundreds of thousands of men. To correct this a brief review of the way a military unit is organized for control and how the signals for each play are gotten down to the last team member seems to be indicated.

Starting with the largest conventional unit, the field army, here is a bird's eye view of it. The *Field Army* consists of its headquarters organization, various special units called army troops, and two or more army corps. Each army corps consists, likewise, of a headquarters, various special units and two or more divisions. Each division, so far as the *Infantry* is concerned, consists of three or four regiments; each regiment, of three battalions; each battalion, of four companies; each company, of three or four platoons; each platoon, of three or more squads or sections, and each squad of somewhere around a dozen individuals. From the squad on up, each team is composed of a number of smaller teams, and each team is a distinct entity with a distinct mission, which must have its own quarterback, its signals and its own means of getting those signals through.

That is why commercial radio doesn't quite fit. If it were not for this involved hierarchy of command it would be simple enough to issue a receiving set to each individual and let the commander-in-chief broadcast his orders, but anyone can see with his eyes shut that he could never give each member of his huge team detailed instruction covering that member's individual job. Each commander can hope to deal effectively only with the commanders of the next smaller units composing his team, and they, in turn, must be depended upon to deal with the next lower echelon. That is the way it is done.

Here is another application for the "walkie-talkie." Note that each of the two soldiers is equipped with a handset that connects to the radio.

Each unit headquarters establishes its own system of communications with the headquarters or the next lower units, and this system is called the *Communications Net* or *Command Net* of that unit. Each lower unit establishes its own separate net linking it to the next lower units, and so on down until the last net reaches and controls the individual rifleman or gunner on the front line. Each net is separate from each other net and must not interfere with it. In addition, at each step in this ladder of command there must, at times, be direct communication with neighboring units of the same kind, on the right and left, and with supporting artillery, aircraft, tanks, etc., with all of whom each phase of the action must be coordinated. The number of stations in each net is kept small to avoid unwieldiness and confusion. Simplicity, reliability and speed are requisite. Failure or delay in any part of any net may become the fatal, missing horse-shoe nail.

The character and make-up of communications nets vary with the size and nature of the unit. In the field army and the army corps it will include all known means of communication, from motor or airplane messengers carrying dispatches on fixed schedules, through the whole gamut to teletype and facsimile transmission by radio or wire, of maps, overlays and similar documents. Because of the distances involved and their relative stability the communication system in these large units approaches that of civil life. As we go down the scale the systems become less and less elaborate and the means employed fewer and fewer. In our *Army* the division is the smallest unit having organically assigned to it a unit of the *Signal Corps,* which may be said to be the professionals of the *Army* in *Signal* communications. It establishes the division net, which usually embraces telephone, telegraph, radio, visual signalling and a well-organized and trained messenger service.

Up until very recently the *Infantry* regiment was the smallest unit to establish a formal command net with technical means. That net extended to the battalions. That meant that from the battalion commander down there was normally no method of communication except messengers. It seems almost incredible that in that zone of the battlefield in which the real fighting takes place, there should have been practically no improvement

(*Continued on page* 92)

Radio in the Armored Force

by Lt.
JONATHAN M. ASKEW

Born near Pontiac, Illinois, January 10, 1913. He had one year active duty at Ft. Monmouth (1938-39) in the 51st Sig. Battalion as a 2nd Lt., Signal Reserve. He entered the Public Utilities Field to become a consulting engineer for illumination and power in the Northern Indiana Public Service Company, Hammond, Indiana in 1939. Lieutenant Askew was called to active duty with the Armored Force on October 20, 1940 and has since been Assistant Signal Officer for the Armored Force Headquarters.

WITHOUT good communication armored units will soon bog down or be eliminated by the enemy. Radio is usually the only communication available during a battle, and it has been organized into nets of two or more stations based on a battle set-up.

Starting with the *Armored Division Headquarters* we have the *Division Command Net* which includes the *Armored Brigade* and supporting units. These supporting units are *Infantry, Engineers, Field Artillery* and *Reconnaissance* units. A *Division Reconnaissance Net* is organized to gather information of the enemy and transmit it to a *Reconnaissance Officer,* who evaluates it and relays the consolidated information to the Commanding General. Another type of net normally handles messages of an administrative nature.

Air-Ground nets are of great importance in getting information from friendly observation airplanes to the proper authorities at Division Headquarters. Bomber demand units are now being used with ground troops to coordinate with friendly bombing planes in getting bombing support at the proper place in the minimum amount of time. Radio forms the vital link between ground units of the *Armored Division* and bombing planes in the air as well as base airdromes. A relay radio station is sometimes used when other equipment is not sufficiently powerful to contact the desired station. Stations used for relay purposes may have the usual low-power equipment, or sometimes a particular frequency is set aside for use by stations of higher power engaged principally in long-range relay work. This may be required from Corps Headquarters to units in the rear echelon of the Division.

Artillery units of the *Armored Force* sometimes use a *Liaison Net, Fire Control Net* and *Fire Direction Net.* The nets referred to in the preceding paragraphs derive their names from the types of messages they normally handle.

Radio is used extensively in convoy control. Usually certain vehicular radio sets occupying strategic places in the column or columns are all tuned to the convoy frequency, and keep watch on this frequency throughout the march.

Another use of radio in the *Armored Force* is the periodical broadcasting of information vital to all, time signals and weather reports.

We will make a short study of a net consisting of tanks only. We will call this Company "A" Command Net. In this company are three platoons of four tanks each. The platoon leaders each have a transmitter and receiver tuned to the company frequency. Under each platoon leader are three tanks equipped with receivers only. These are known as combat tanks; their main purpose is to fight, and they do not have sufficient room to carry a transmitter installation and still be able to fire all their guns and carry sufficient ammunition. They can receive messages and orders by radio, but must acknowledge receipt by some other means, or else not at all.

The net control station of this net would be that in the company commander's tank, and he has to monitor both his own net and that of the next higher headquarters. To do this properly he must have two receivers. If he has but one receiver he has to keep tuning from one frequency to the

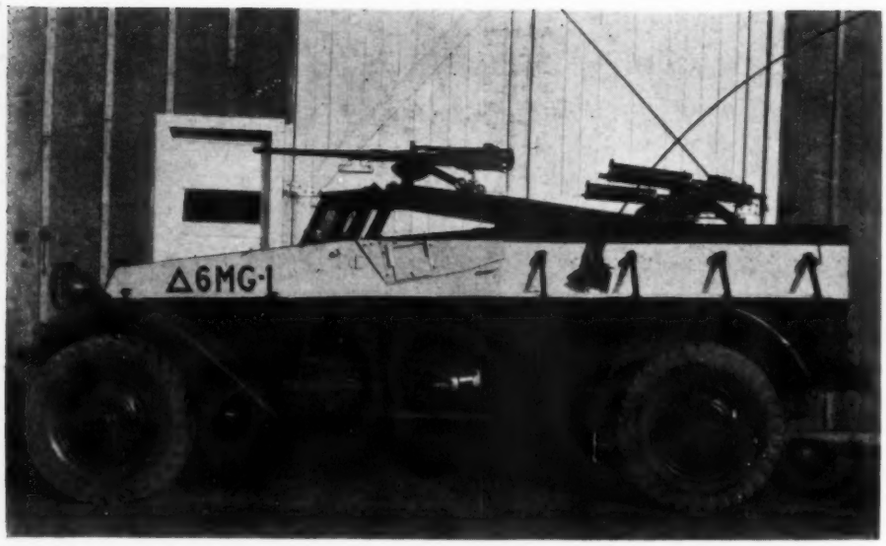
The antenna on the tank to the right is tied down to prevent too much whipping and to protect it from trees.

Time is one of the vital factors in the operations of an armored force. Only men with special training handle radio units.

Scout car and field artillery elements of the 1st Armored Division in action.

Radio-equipped scout car moves into position for action.

This light tank is completely radio-equipped.



This scout car is armed with machine guns. Note tied-down radio antenna.

Light tanks in line formation.

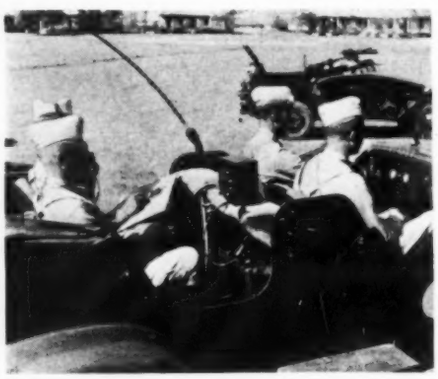
other; he may, while busy in one net, miss a communication of vital importance in the other net. Normally each net will work on its assigned frequency, and individual stations will not tune to another frequency unless so directed by their net control station. Note that the company commander, operating the control station of his own company net, is also a subordinate station in the net of the next higher headquarters; thus the nets link together like a chain.

The foregoing brief sketch cannot give the true picture of an *Armored Division* in action. Among the host of highly-trained specialists required to keep these mechanized units rolling must be thousands of well-trained radio operators; hundreds of expert radio electricians; and finally, to supervise the systems, specialized Signal Communication Officers, skilled in radio, telephone, message center work, and the tactical employment of the various agencies. And let it be emphasized, they must all be experts. In the operations of an armored force, time is one of the vital factors. Just as the automotive mechanic has not time for a leisurely diagnosis of an ailing tank engine, so the radio electrician can make no leisurely diagnosis of an ailing radio receiver. When an armored force goes into action, the heat is on; every man is working under pressure. Obviously an institution with extensive facilities for the training of large numbers of specialists in such diversified fields as for instance the maintenance and repair of tanks, instruction in gunnery, headquarters clerical work, radio operating, becomes a "must" in planning the organization and maintenance of an armored force.

Under the able supervision of Brigadier General Stephen G. Henry, Commandant, the *Armored Force School* was organized and plans were made to enroll the first classes of students on November 4, 1940. The problem involved construction of school buildings, selection of suitable instructors, planning complete courses in every detail, preparation of instructional material and assembling instructional equipment.

The *Communication Department,* one of the nine departments of the School, was organized under the direction of Lt. Col. Leslie F. Lawrence to handle some 1800 students simultaneously in three-month courses on a staggered schedule similar to the modern assembly line.

Certain units of the *1st Armored Division* at Fort Knox, Kentucky, and the *2d Armored Division,* Fort Benning, Georgia, gave generously of some



Officers give orders from command car.

of their best non-commissioned officers to be utilized as instructors in the Communication Department. In addition, several very capable Regular Army Officers and a group of highly-proficient Reserve Officers who had specialized in Communication work in civil life were also added to the department to complete the instructional staff.

The majority of the students now being trained in the Radio Operators' Course and the Radio Electricians' Course are Selective Service men detailed to school from the *Armored Force Replacement and Training Center* for further training as Signal Communication Specialists, following their preliminary instruction in basic military training. After completing their training in the *Communication Department,* some few are retained as non-commissioned instructors and the balance are sent to *Armored Divisions.*

Experience has demonstrated that the more successful graduates are those who have the following qualifications when they enter:

First and foremost, the student *must* have a definite interest and a desire to learn more about radio.

Second, the student should preferably be a high school graduate or have an equivalent education.

If he is to train as a Radio Operator, he should be able to pass the Signal Corps Code Aptitude Test* with a score of 55 or better. If he is a "Ham," so much the better.

If he is to train as a Radio Electrician, he must have mechanical aptitude and should preferably be an operator (because he gets no training in this subject). If he has had some radio service experience or has built his own sets or has had some correspondence school work in Radio, he will find the work much easier.

In the final analysis the quality of the graduate depends, to a considerable degree, upon the initiative, inherent ability and native intelligence of the man who is sent to the school. Students seriously lacking in these qualities seldom graduate.

* NOTE: The *Signal Corps Code Aptitude Test* is a test given to determine the ability of the student to distinguish between sounds. He does not have to know the International Morse Code; merely be able to state whether one character sounds like the preceding one or is different. The test is not infallible but gives a very good indication as to whether the student possesses the qualities of perception and rhythm as they apply to radio signals.

The majority of students are detailed to take the Radio Operators' Course. This course is intended to train men as competent "table operators." In the past, due to the limited

time and the shortage of equipment, it was necessary for the operator to gain his proficiency in field operation after he joined his unit. In the future considerably more training in field operation will be given in the school and thus, this period of "post graduate" training can be shortened considerably.

During his training period, the student radio operator devotes half of his time in learning the International Morse Code and developing operating rhythm and speed. One of the requirements for graduation is the ability to receive sixteen words per minute. He must also be able to transmit twelve words per minute. Tests consist of mixed numbers and letters—not "clear" text. He first learns the alphabet and numerals and then learns to handle messages, using *Army* procedure. Automatic sending and recording devices are used in the greater part of the instruction and, through a system of monitoring and frequent progress tests, each student is able to advance as fast as his ability permits completely independent of all other students. Because of this instructional feature, students with high aptitude often reach high receiving and transmitting speeds in the allotted time. Advanced students are afforded opportunity to copy Press during certain periods.

All operators are taught the standardized Joint Army and Navy Operating Procedure, which results in the handling of traffic in the minimum of time with accuracy, speed and efficiency. Since many military messages must be encoded or enciphered, operators are also given some instruction in cryptographing and decryptographing.

In preparation for practical radio operation, the student is given instruction in the fundamentals of Electricity and Magnetism and Radio Theory. He then proceeds to a detailed study of the vehicular and portable radio equipment used by Units of the *Armored Force.*

During their final days at school, all students now taking the Radio Operators' Course participate in practical communication exercises. As additional equipment becomes available, the amount of time devoted to this type of instruction is being constantly increased.

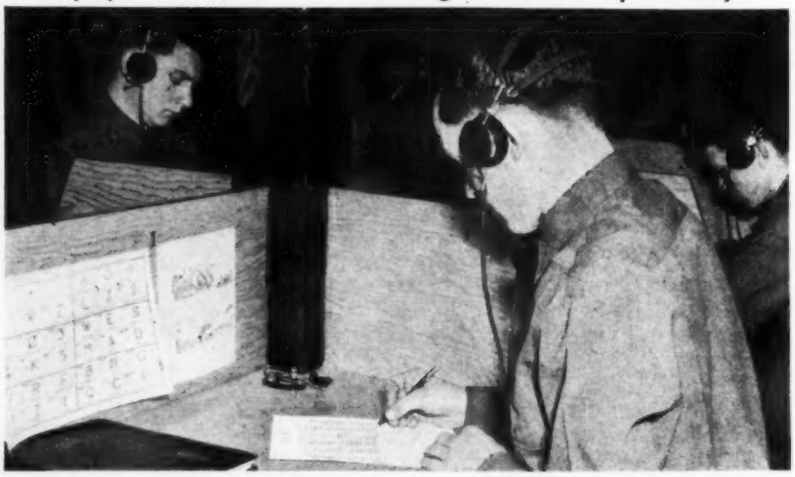
The *United States Army* naturally requires that its radio equipment be kept in proper operating condition. In view of the large number of vehicular and portable radio sets utilized by the various units of the *Armored Force,* this has necessitated the training of a large number of radio electricians and repairmen and it was found necessary to organize a separate course to train men in the installation, repair and maintenance of radio equipment.

These classes are much smaller than the Radio Operator's classes and each student is given a large amount of practical laboratory and shop work in addition to attending lectures and conferences. Fundamental subjects taught include: Electricity and Magnetism; Basic Shop (including the use of electricians' tools); Radio Theory (including practical laboratory experiments); Batteries and Power Systems; and the study and use of radio test equipment such as volt-ohm-meters, tube checkers; frequency meters and signal generators. Following this preparatory work, the student Radio Electricians are given instruction in every *Signal Corps* radio set used in the *Armored Force* and they thus become thoroughly familiar with them. Emphasis is placed upon testing and trouble shooting on both receivers and transmitters and all work is carefully supervised and directed in an efficient manner

Close-up of a medium sized tank roaring over a road block, or trap.

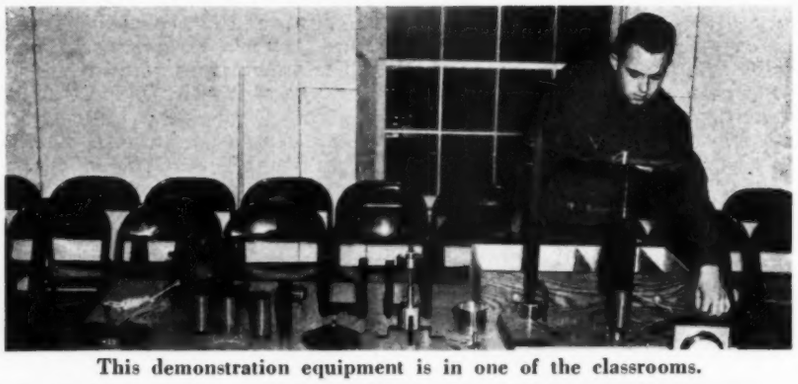
A vehicular radio set being installed in a scout car in the shop.

Equipment Used in Training Personnel for Duty.

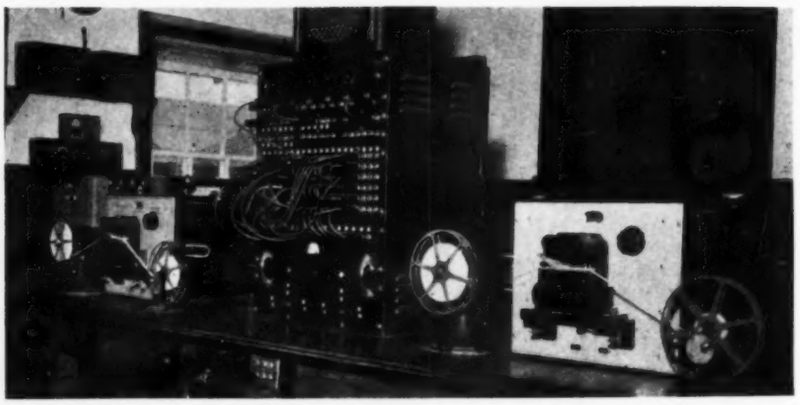


Students begin their training by learning the international Morse code.

Shop work follows under expert instructorship and with ample tools.



This demonstration equipment is in one of the classrooms.



This bank of tape-fed code transmitters is of the latest design.

by competent instructors. Radio Electricians are also trained in installation and adjustment of portable and vehicular stations, including cording and shielding.

In view of the recent adoption of frequency modulated transmitters and receivers, these sets come in for their share of study, together with F. M. circuits and set servicing.

The Communication Officer's course is given to selected Regular Army and Reserve Officers. A great deal of attention has been given to the preparation of the course, as the "Com O." (as he is known) has the responsibility for supervising all matters relating to the *Signal Communication System* of his unit including radio nets, personnel, care, use and maintenance of equipment, operation of the message center, employment of the motorcycle messengers, and a multitude of other matters. The course covers not only the technical aspects but also a study of the tactical considerations as well. Not only will the graduate have responded to his Country's call "for all to lend a hand in National Defense" but, at the same time, he has gained invaluable training and experience.

There are many other means of communication besides radio which are used in the *Armored Force,* but radio is more extensively used than any other type, especially during battle. In other cases, for example in bivouac area, wire communication is extensively used. Wire communication includes not only telephone but also teletype and telegraph. Telephone and teletypewriter can be used on the same circuit by simplexing. This system saves a large amount of wire and requires less labor in constructing lines.

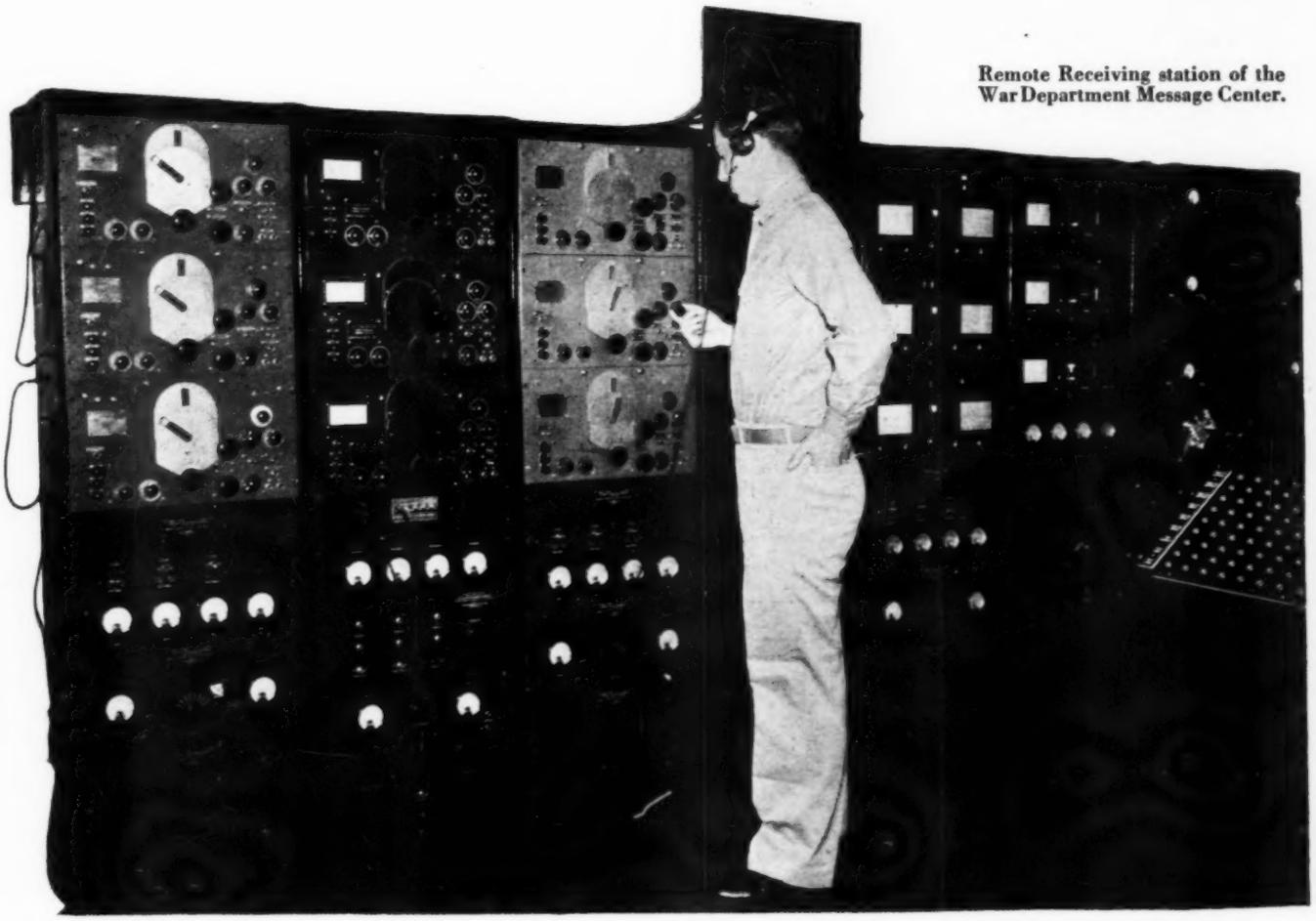
Visual signals are used considerably in the *Armored Force.* The types are: pyrotechnics, panels, flags, lamps. Pyrotechnics are colored flares which are projected either from an airplane or from the ground. Panels are used to communicate with friendly airplanes. Numerals are displayed, together with identification group or indicator, which refers to the numbered code group, meaning of which is found in a code manual. The identification group indicates whether the numerals displayed refer to a prearranged message or are coördinates of a location on the map. Other identification groups are used to identify a particular headquarters.

All armored vehicles such as tanks, scout cars and half-track personnel carriers are equipped with flags. These are used to signal during a march on the road. Still another type of signal which may be mounted on an armored vehicle is the lamp for short-distance communication at night. The *Armored Force* also utilizes airplane pick-up of messages from the ground, motorcycle messengers and pigeons.

The signal specialists (both officers and enlisted men) have a very important job in the *Armored Force.* They are doing it too!

(*Continued on page* 104)

WAR DEPT. RADIO NET



Remote Receiving station of the War Department Message Center.

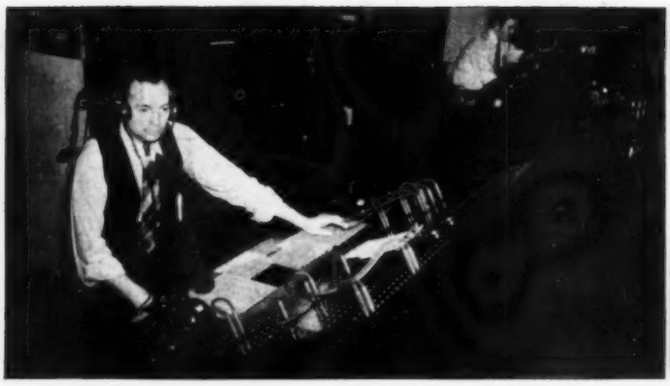
The War Department has a radio network that handles all of the business pertaining to the operation of its office.

by Lt. Col. EDWARD F. FRENCH

Heads activities of the War Department Message Center and Traffic Division in the office of the Chief Signal Officer, Washington, D. C. A veteran Signal Corps Officer with more than 24 years communication experience. He is a native of California, has been directing the activities of the Army's radio network and its many associated functions for the past few years. He has a force of 130 civilians and 50 soldiers under his command that handle the numerous functions within his department.

ON the third floor in the rear of the sprawling, white-faced Munitions Building in Washington, which was erected during World War I, and still houses part of the ever expanding War Department offices, is located a virtual beehive of activity. It is the Army's communication nucleus —officially known as *The War Department Message Center.* Through this office daily pass thousands of messages pertaining to the administration of the Army, changes in personnel, orders for the movements of troops, purchase orders for clothing, equipment and other necessities for our expanding Army. In addition to the War Department business, the Message Center handles radio traffic for about 50 other government agencies as the *Department of Interior, Treasury Department, Farm Credit Administration, Civil Service Commission, Civil Aeronautics Administration, Federal Power Commission, Federal Trade Commission,* and so forth, just to mention a few. To handle this large volume of traffic, which at present approximates 10,000 messages daily, use is made of the most modern radio and wire facilities of the communication art. These include teletypewriters, TWX service, manual and high speed visual recording radiotelegraph equipment and recently developed radio typewriter channels.

The operation of the *War Department Message Center,* with its many closely affiliated activities, is a responsibility of the Chief Signal Officer, Major General Dawson Olmstead, who is assisted by Colonel O. K. Sadtler, in charge of the Operations Branch. The *Signal Corps* is charged with the development and operation of Army communication systems, particularly



The War Department Message Center control board.

Home of the AARS net control station WLM-W3USA.

the fixed radio, telegraph and telephone installations at Army and Corps Area headquarters, posts and training camps. The Message Center in Washington may well be defined as the nerve center of the Army's vast communication system which covers the United States, Alaska and Puerto Rico and also extends to Hawaii, Philippine Islands, Panama Canal Zone and, more recently, to our leased bases in Greenland, Iceland, Bermuda, and the West Indies.

The multitude activities of the *War Department Message Center* and of the Traffic Division of the Office of the Chief Signal Officer, Washington, D. C., which administers its operations, are under the direct control of Lieutenant Colonel Edward F. French, a veteran Signal Corps officer with more than 24 years communication experience. Colonel French, a native of California, has been directing the activities of the Army's radio network and its many associated functions for the past few years. He has a force of 130 civilians and 50 soldiers under his command to handle the numerous functions of his department. Assisting Colonel French, as Chief Operator, is Master Sergeant Merle G. Glover, who has had 23 years of Army service since he left his home in Marquette, Michigan. The Assistant Chief Operator is Master Sgt. George Fetchko, a veteran of 16 years army signal service.

The inception of a radio network for handling the *War Department's* business dates back to shortly after the first World War. During the year 1921, the *Signal Corps* installed radiotelegraph stations at most of the nine Corps Area headquarters with the master or net control station in Washington, D. C. In addition to these principal stations, smaller ones were established at many military posts and camps, primarily for emergency communication requirements. All stations were authorized to handle urgent telegraphic business. Approximately 72 stations were included in this *War Department Radio Net* at the end of 1922. By 1929, there were 212 radio stations in this network covering practically all Army posts and connecting these posts to their respective Corps Area headquarters which, in turn, were connected to the *War Department* at Washington, D. C., through net control station WVA. Today, there are more than 300 stations in the Army's radio network serving the United States and its Possessions.

On March 23rd, 1923, the *War Department Message Center* was first established in the Office of the Chief Signal Officer in Washington. It is the centralized bureau for handling the official dispatches of the *War Department* and certain other government agencies. The facilities of the *War Department Radio Net* primarily are utilized for this traffic.

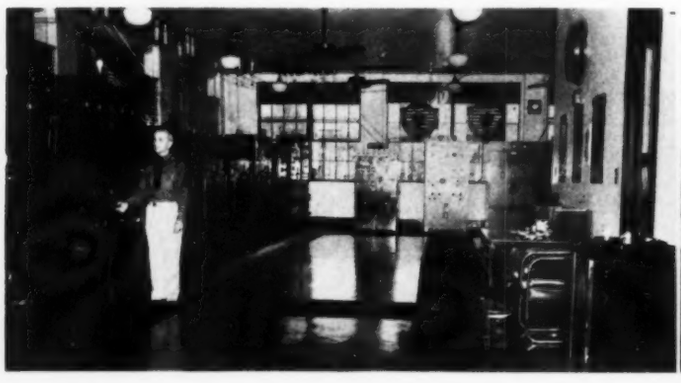
When the *War Department Radio Net* was first organized after 1920, all operations were on the low frequencies in the 50 to 100 kc. band (3000 to 6000 meters). 30 kw. Arc sets were employed at San Antonio, Texas; Fort Leavenworth, Kansas, and Fort Douglas, Utah, and 10 kw. sets at Atlanta, Ga., San Francisco, Calif., Columbus, Ohio, and Chicago, Ill. With the rapid advancements in the radio art, these obsolete arc sets soon were replaced by tube sets operating in the intermediate frequency bands. WVA, the net control station in Washington, used a 20 kw. tube set from 1922 to 1928. Messages destined to San Francisco from Washington would be relayed through Fort Hayes, Ohio, Fort Leavenworth, Kansas, and then Fort Douglas, Utah, to reach San Francisco. It was considered fast service in those days if a radiogram filed in Washington one day reached San Francisco, the next day. Important messages had to be sent by telegraph.

In the latter part of 1927, the intermediate frequency tube sets were replaced by 1 kw. high frequency transmitters operating in the 4000-18,000 kc. range. By 1929, messages from Washington to San Francisco required relaying at only Fort Leavenworth, Kansas. The call letters of the *War Department* net control station in Washington were changed from WVA to the present WAR call on November 30, 1928.

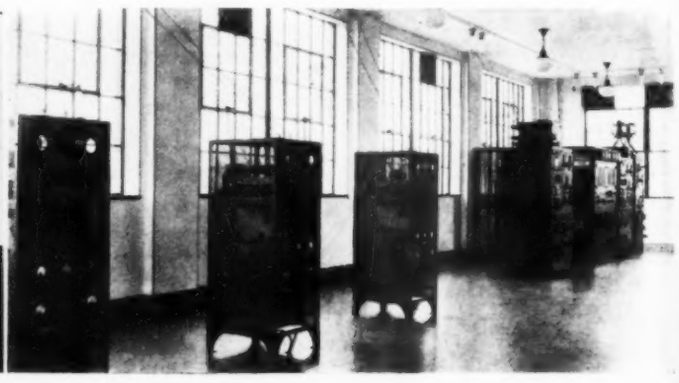
A new building housing the WAR transmitters was constructed on the Fort Myer reservation, across the Potomac River from Washington, in 1929. On March 22, 1930, station WAR was placed in operation in its new location employing the latest radio equipment of that day. Direct contact was established with San Francisco and later with Seattle, Washington, Hawaii and Manila, P. I.

(*Continued on page* 90)

Adjusting the 10kw transmitter at Fort Myer, Myer, Va.



Interior of the old WAR station back in 1928.



Sgt. N. C. Richardson, W3GUV, Pvt. J. Dortot, W2NDV, and Maj. David Talley, W2PF at WLM/W3USA.

AARS

The relaying of messages between amateur stations and public is an important function of the AARS.

by Major DAVID TALLEY

Born in New York City, October 20, 1903. Commissioned 1st Lt. in Signal Corps. Reserve Oct. 1926; promoted to Captain in October, 1930 and to Major in September, 1940. On extended active duty as Liaison Officer, AARS since November 1940. Member of the Army Amateur Radio System since its organization in 1926 and served in capacity of 2nd Corps Area Radio Aide from 1927 until called to active service in 1940. Major Talley is an ardent Ham and an outstanding authority on radio matters.

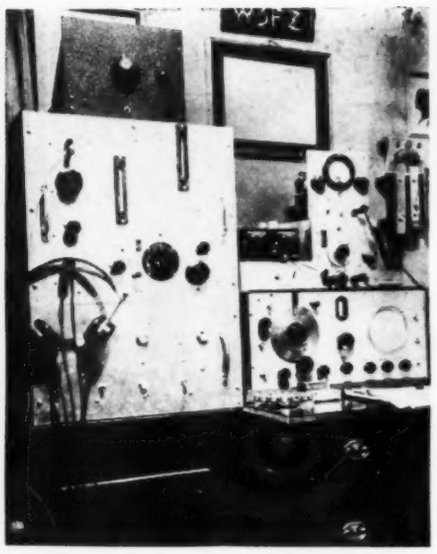
"ZCVA V WLM." That radio call heard Monday nights at seven o'clock E.S.T. is the signal for the beginning of the weekly drill period for members of the *Army Amateur Radio System*. "ZCVA" is the general call meaning that all Army Amateurs should copy the succeeding text. WLM is the special call of Army Amateur net control station W3USA in the Office of the *Chief Signal Officer,* Washington, D. C., which serves as the center of all drill operations.

The great value of the "Ham" as a source of radio operators for the Army, first was demonstrated more than 23 years ago when about 3,500 served as radio operators with the military forces during World War I. In the past years, the radio amateur's value to his community has been brought to the public's attention many times when floods, hurricanes and earthquakes had seriously disrupted wire communications. In recent months, thousands of amateur radio operators, including many Army Amateur members, have deserted their receivers and transmitters at home to serve the Army's communication needs.

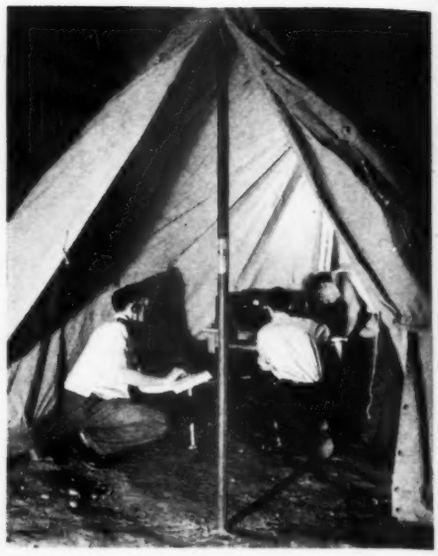
The potential public service of the radio amateur early was recognized by the *War Department* when organization of an Army Amateur radio group was first attempted immediately after the last World War. However, it was not until 1925 that the Chief Signal Officer, in cooperation with the American Radio Relay League, was able to launch the *Army Amateur Radio System*. The initial membership was small, comprising about 300 amateurs. In 1929, the AARS was expanded to become a nation-wide radio communications group with one of its prime purposes to assist the American Red Cross in emergencies. Membership increased steadily from about 500 in 1930, 1100 in 1935, to 1700 in 1939. Today, as a result of the revised plan of affiliation of the Chief Signal Officer to make the *Army Amateur Radio System* an auxiliary civilian unit in the defense picture, membership has increased to more than 2,400. It is hoped that in the near future there will be at least 5,000 "Hams" cooperating with Uncle Sam in his defense communication plans.

The *Army Amateur Radio System* has been developed as a voluntary af-

AARS Net Control Station W4NC-WLMC.



Army Amateur Station W3FZ-WLMP.



Net Control Station W2SC on field day.

filiation between the *Signal Corps* and the civilian radio transmitting amateurs of the United States for the following purposes:

a. To provide additional channels of radio communication throughout the continental limits of the United States that may, in time of emergency, be used to augment or replace the land lines, both telephone and telegraph, that might be seriously damaged or destroyed by flood, fire, tornado, earthquake, ice, riot or insurrection.

b. To place at the disposal of military commanders of all components of the Army of the United States and representatives of the *American Red Cross* such amateur radio channels of communication as may be developed under this plan.

c. To provide civilian amateur radio operators with a knowledge of Army methods of radio procedure and of the methods of using radio as a means of signal communication "in the field."

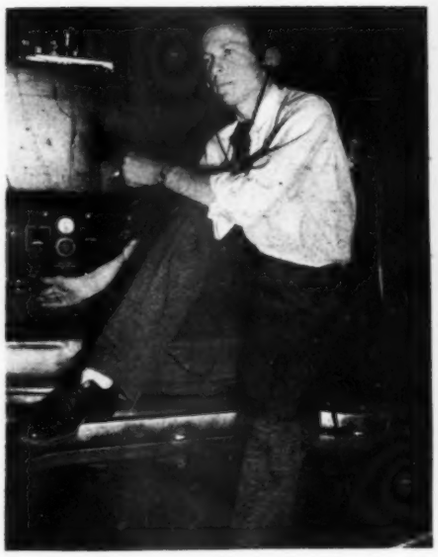
d. To establish contact with a considerable number of civilian amateur radio operators for the purpose of acquainting them with the *Signal Corps* and its activities and securing their aid in experimental work, tests, etc.

e. To render such encouragement and assistance as may be desirable to firmly establish and perpetuate the American Amateur.

The Chief Signal Officer of the Army is responsible for the administration of the AARS. He usually details an officer on duty in his office to serve as the Liaison Officer, AARS, for administering the operations of the system. The present Liaison Officer is Major David Talley, W2PF, who has been an active amateur for 26 years and a member of the AARS since its inception. An outstanding radio amateur is appointed by the Chief Signal Officer to be the Chief Radio Aide who will act as the civilian representative of the transmitting radio amateurs. Dr. Lawrence J. Dunn, W2CLA/WLMD, Garden City, N. Y., is the present Chief Radio Aide. Dr. Dunn's amateur radio experience dates back to 1908. He collaborated in the formation of the *Army Amateur Radio System* in 1926 and had previously served as the first Chief Radio Aide from 1929 to 1934.

The operation of the system in the nine corps areas, into which the Army is divided for administration purposes, is under the control of the *Corps Area Signal Officer*. He assigns an officer as the Corps Area Liaison Officer or agent to assist in this connection and appoints a qualified Army Amateur member, residing in the corps area, to serve as the *Corps Area Radio Aide*. Army Amateur stations are grouped into nets starting with the *Army Net*, which is controlled by Army Amateur net control station WLM/W3USA, Washington, D. C. This net comprises the corps area net control station or "NCS" of each of the nine corps areas and of the Panama, Puerto Rican, Hawaiian and Philippine Island Departments. Each corps area net consists of the Corps Area NCS and the State net control stations of the various States comprising the corps area. The State nets, in turn, contain the remaining Army Amateur stations in the State. In some States, there may be further subdivisions into District and Local nets if the number of stations warrant it. All stations in a state net usually are assigned to operate on the same amateur frequency channel.

Monday night is the official drill period for all Army Amateur members. Promptly at 7:00 p.m., E.S.T., they man their amateur stations to receive the "ZCVA" general broadcast message from the Army NCS, WLM, Washington, D. C., on the special 3497.5 kc. and 6990 kc. frequencies. This message usually contains instructions for special drills, tests or contests plus general information of value to all members. The several nets in each Corps Area, as well as the Army net,



Pvt. L. S. Thompson, photographer.

operate daily except Sundays. This affords members opportunities to take turns acting as the net control station and provides for the prompt handling of amateur message traffic.

The various Corps Area and State radiotelegraph nets in each corps area normally operate on different single frequencies in the amateur 160 and 80 meter bands. In a few corps areas, there are nets working in the 7000-7300 kc. amateur band but the majority of AARS stations function on the 3500-4000 kc. band. The net frequency allocations are coordinated by the Liaison Officer, AARS, between the different corps areas. A separation of 2.5 kc. is used for c. w. (telegraph) nets and 5 to 10 kc. for radiotelephone nets. The few amateur frequencies are insufficient to provide clear channels for all the nets so that it is necessary that many nets utilize the amateur frequencies on a shared-time basis.

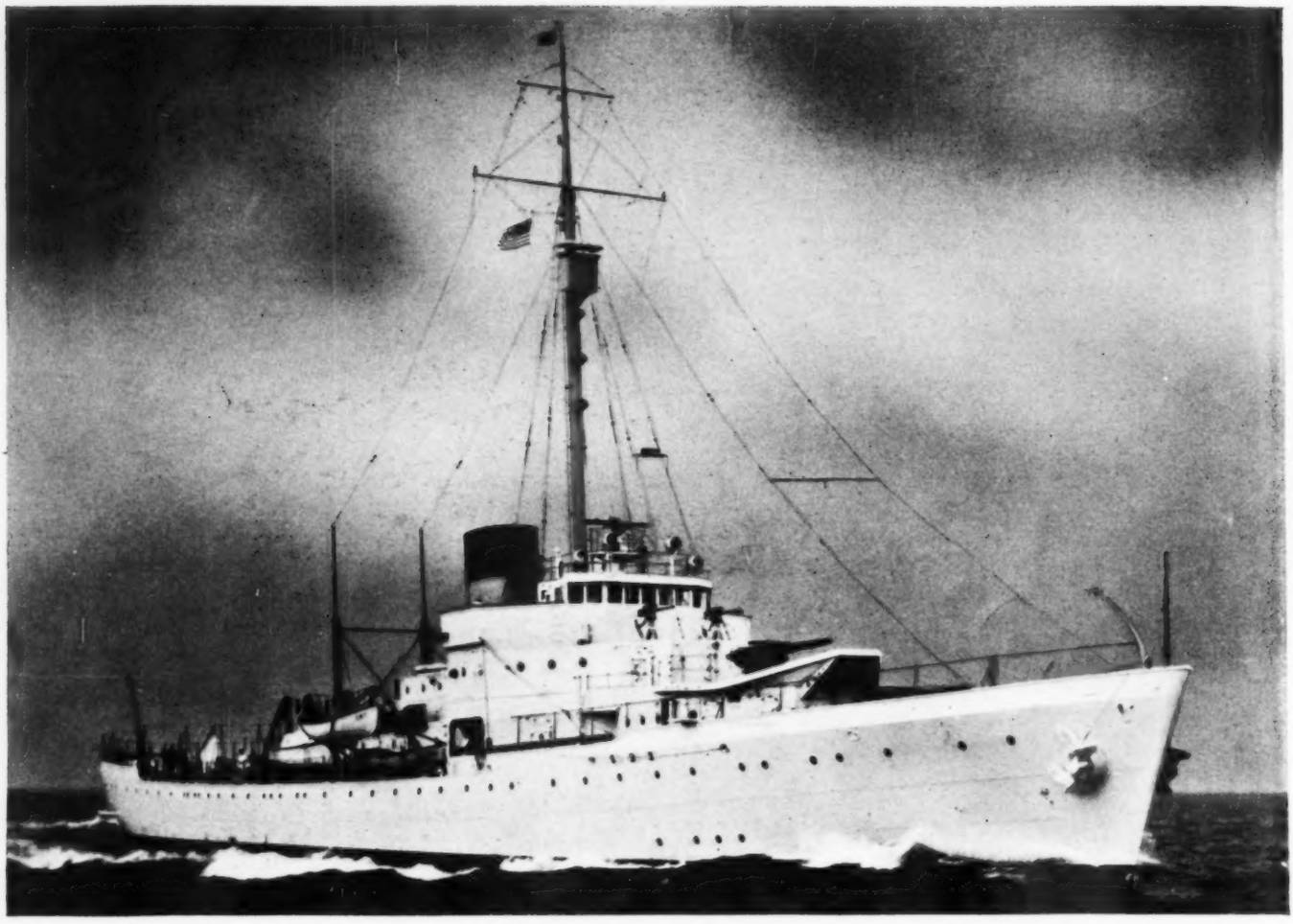
About one third of all Army Ama-

(*Continued on page* 88)

Radio-equipped Gruman JF-2 Patrol.

RADIO in the COAST GUARD

Whether on an errand of mercy in time of peace, or on a mission of death in war, the Coast Guard is ever ready for any emergency.



A 327-foot Coast Guard Cutter showing multi-purpose antenna system. Note insulators in rigging.

by Commander J. F. FARLEY

was assigned as Chief Communication officer of the Coast Guard at Coast Guard Headquarters, Washington, D. C., in March, 1937 and is still so serving. He served on the cutter YAMACRAW during the last World War. In later years Commander Farley was in command of destroyers and cutters on various duties including International Ice Patrol and for a time, 1930-1933, he was gunnery officer on the destroyer FORCE in New London. A graduate of the Coast Guard Academy, class of 1912.

THIS article proposes to discuss the use of radio in the *Coast Guard* and to show briefly how and why, through radio, the *Coast Guard Communication System* has developed into the intricate and far flung organization that it is today. It will also describe the types of radio installation required, equipment used, and training facilities available to those desiring to serve in this branch of the service. However, before beginning, it would be well to state in general what the duties and responsibilities of the *Coast Guard* are, in order that the need for a *Coast Guard* radio communication system can be seen and the purpose, or ultimate objective, of such a system may be more clearly understood.

Under existing laws, Presidential executive orders and regulations, the *Coast Guard* is charged with the following:

1. The prevention, detection and suppression of violations of laws of the United States on the high seas, in harbors, bays, sounds, roadsteads and like bodies of water along the coasts of the United States, its territories and possessions, and shores of the Great Lakes, and on the Great Lakes and the connecting waters thereof.
2. The securing of the collection of import duties and the building of cutters to protect the revenue. *Coast Guard* officers shall be deemed officers of the Customs.
3. The enforcement of the navigation laws.
4. The enforcement of neutrality.
5. The enforcement of anchorage rules and regulations, rules governing movement of vessels in the St. Marys River and the Oil Pollution Act.
6. The enforcement of the provisions of international conventions and treaties to which the United States is a signatory, which embrace the following duties:
   (a) Patrolling waters of the Pacific Ocean and Bering Sea frequented by the fur seal herd and the sea otters for the protection of these animals.
   (b) Patrolling such places and waters as seem expedient for the preservation of the halibut fishery of the northern Pacific Ocean and the Bering Sea.
   (c) Enforcement of the provisions of the act giving effect to the convention for the regulation of whaling.
   (d) Maintaining a patrol of the waters along the trans-Atlantic steamship tracks endangered by icebergs.
7. Enforcement of the provisions of the law relating to the sponge fishery in the Straits of Florida and Gulf of Mexico.
8. Preservation and protection of lives and property endangered at

Radiobeacon buoy in Boston Harbor.

Coast Guard Light Station. Note the cage antenna between steel masts.

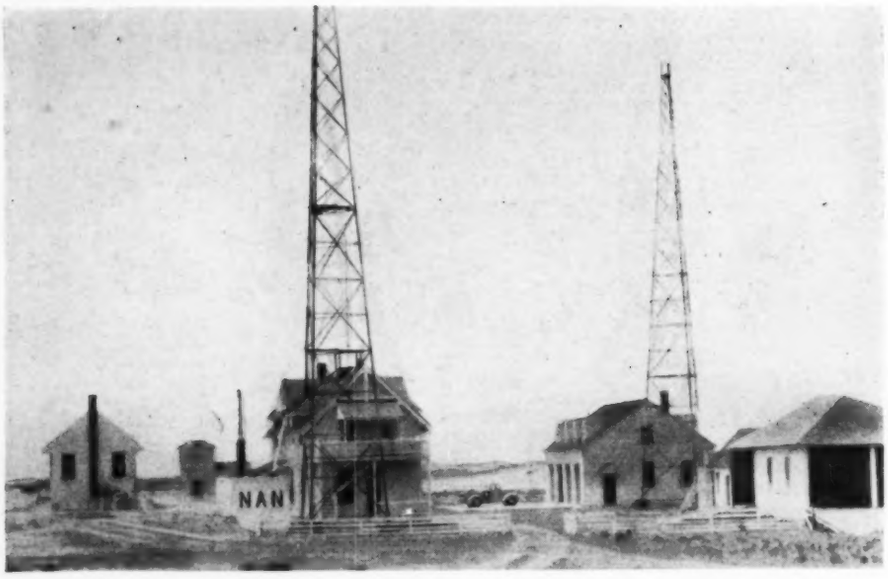
sea, shipwrecked or marooned along the coasts and on the Mississippi and Ohio rivers and their tributaries, and the patrolling of said waters for rendering aid to vessels in distress. Enforcement of the regulations to promote the safety of life and property on navigable waters during regattas or marine parades. Extending medical and surgical aid to the crews of vessels engaged in deep sea fisheries and to aid distressed mariners as required.

9. Removal and destruction of derelicts.
10. Training of personnel on American merchant vessels.
11. The construction, operation, maintenance, repair, illumination and inspection of all aids to navigation.
12. Shall constitute a part of the military forces of the United States and shall operate as a part of the *Navy* in time of war or when the President shall so direct.

The personnel and material of the *Coast Guard* are, of course, so organized and constituted as to perform the duties outlined above. Those duties require, in general, the construction, operation and maintenance of a great many vessels of various types from small motor boats to vessels of over 2,000 tons capable of remaining far at sea in all seasons and in all weather; the maintenance of lifeboat stations along the entire United States coast line and on the Great Lakes; the establishment and maintenance of light stations, fog signals, radio beacons, lightships, buoys, and all other types of fixed and floating navigational aids whatsoever, in the United States and along its coasts, on the Great Lakes, in Alaska, in the Canal Zone and in the island possessions; the establishment of administrative offices, depots, bases for the administration, maintenance and repair of this organization and its material. The organization of the *Coast Guard* is, of course, headed by a central administrative office, *Coast Guard Headquarters,* Washington, D. C., where the Commandant is chief administrative officer of the service.

It can be seen from the nature of the duties outlined above that the *Coast Guard* is preëminently an emergency service. Smugglers do not publish the locale and scale of their operations so that there can be planned action in sufficient force against them; the places where hurricane, flood or marine disaster may strike cannot be accurately foreseen. And so it is with most of the duties listed. Even the carrying out of the provisions of treaties into which the United States has entered, such as the International Ice Patrol, is an emergency duty. The icebergs do not obligingly appear on exactly the same date each year and the last one melt on the final day of the "ice season." Sometimes they do not appear at all, and sometimes they come months before expected. Therefore, the *Coast Guard* must be prepared to sail on moment's notice and stay until it is over. The maintenance of all aids to navigation, though not on first thought, is also an emergency duty. Mariners are dependent on the continued presence and accurate operation of all the aids. Missing or inoperative buoys, lights and radio beacons must be promptly replaced and repaired. Therefore, in peace or in war, 365 days a year, year in, year out, the *Coast Guard* is on duty, not preparing for some known emergency, but prepared, day after day, for the

This 83-foot cutter is equipped with a low-power radio transceiver.



Coast Guard Radio Direction Finder and Lifeboat Station, Cape Lookout, N. C.

unknown, the unexpected catastrophe.

A primary requisite of an emergency service is the prompt receipt and fast, efficient dissemination of all information with which it is concerned. The *Coast Guard Communication Service* is established to supply this need. The mission of this service may be expressed as follows:

(a) To furnish efficient communication to all units of the *Coast Guard.*

(b) To provide for the immediate receipt of all distress information (shipwreck, hurricane, flood, etc.) from all sources and to pass this information on with the utmost speed and accuracy to all agencies, *Coast Guard* and others, capable of rendering aid.

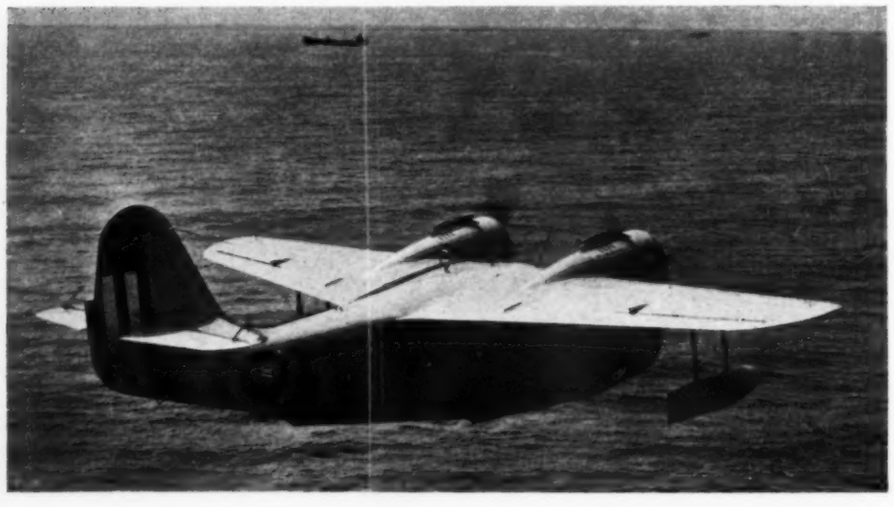
(c) To be so organized, equipped and trained that operation as a part of the United States naval forces when the President shall so direct may be accomplished with a minimum of operational change and difficulty.

(d) To maintain communication security.

The *Coast Guard Communication Service* must maintain and operate a system such as will permit the *Coast Guard* to carry out successfully all the duties with which it is charged. The Commandant must be able to rapidly and accurately direct the activities of any individual unit or group of units in the service. The Commanders of the 16 *Coast Guard* Districts, which cover continental United States, Alaska, Hawaii and Puerto Rico, must be able to do the same within their districts. And, reciprocally, every unit or group of units must be able to report back to the District Commander, or Commandant, swiftly and accurately, its activities. These communications must pass up and down the chain of military command and still maintain speed, accuracy and, if necessary, security.

Such a system would require that each individual operating unit from a small motor boat to the largest cutter or training vessel, and from an isolated light station in Alaska to the Commandant's office in Washington should have two-way communication at all times with any other *Coast Guard* unit via the *Coast Guard Communication Service.* The communication chain must be unbroken, even during major disasters covering wide areas or long stretches of coast line where wire and cable communication are disrupted or totally destroyed, and communications must be maintained with all mobile units, ships, aircraft and trucks, wherever they may be. This means radio! There can be no substitute. Every *Coast Guard* owned or leased telephone line, teletype circuit or submarine cable must, for emergency, be supplemented by an adequate radio circuit.

Amphibian V-190 in flight. Note the direction-finder loop on the wing.



With these ideas in mind, the need and purpose of the *Coast Guard Communication Service,* and the important place of radio in it, can be readily seen. Also, the form, the skeleton at least, of what the system is, or rather of what it should be composed, becomes apparent. We are, therefore, ready to discuss the use of radio in the *Coast Guard* and to describe briefly, the types of radio installation required and the equipment used.

The *Coast Guard* is divided into 16 districts for administrative purposes. The name of the district is taken from the name of the city where the district commander has his administrative offices. The districts are as follows:

Atlantic and Gulf Coasts—Boston, New York, Philadelphia, Norfolk, Charleston, Jacksonville, New Orleans and San Juan (Puerto Rico).

Pacific Coast—Seattle, San Francisco, Los Angeles, Ketchikan (Alaska) and Honolulu (Hawaii).

Great Lakes—Chicago and Cleveland.

Mississippi and Ohio Basin—St. Louis.

The main elements in the communication system are so called primary radio stations, one in each district, Washington Radio and the following other types of radio stations: secondary radio stations and air, radio telephone control, lifeboat, light station and light ship radio stations. For purposes of control, these stations are divided into two radio fixed networks, one, the primary net consisting of the district primary stations under control of *Coast Guard Washington Radio* and, two, the secondary nets within each district consisting of all the radio stations in the district under the control of the district primary station.

The primary net provides interdistrict communications and with Washington to coördinate the operations of the *Coast Guard.* The secondary or district nets provide the district commander with the means to coördinate sea, land and air activities within his district. As with most fixed nets, the purpose of the *Coast Guard* land radio station system is primarily to facilitate mobile operations. The shore radio stations provide ship-shore communication for the *Coast Guard* cutters, tugs, tenders, picket boats and motor boats operat-

Remotely-controlled transmitter house.

Coast Guard primary radio station. Receiving building and antennae towers.

ing within the districts. As stated above, *Coast Guard Radio Station,* Washington, D. C., is the control station for the primary net and, in addition to that responsibility, this station performs other special duties such as providing ship-shore communications for the Cadet Practice Squadron on the summer cruises, International Ice Patrol Service guarding the trans-Atlantic steamer lanes from the menace of icebergs and field ice, the Atlantic Weather Observation Service furnishing the *United States Weather Bureau* with daily observation of the surface and upper air to safeguard trans-Atlantic aircraft, and vessels of any other independent mission operating directly under the Commandant.

Another phase of radio use in the *Coast Guard,* which has not as yet been specifically mentioned, is communications for the *Coast Guard* air arm. Any aviation service requires a ground aeronautical net to guard planes in flight. The *Coast Guard* has nine air stations along the Atlantic, Gulf and Pacific coasts. These stations have radio stations which together form the *Coast Guard* aeronautical network. The primary and secondary radio stations often enter into this net and any *Coast Guard* radio station, land, ship or vehicular, may become a part of the net also, when joint operation of ships, shore stations, aircraft and trucks require it.

There are in all 24 primary and secondary radio stations, 9 air radio stations, 4 radio telephone control stations, 156 lifeboat radio stations, 310 light station radios, 39 lightship and relief lightship radios. Mobile radio stations are as follows: ship stations, 78 seagoing cutters, 67 smaller cutters (less than 100 feet long), 68 cutters of the tender class, 14 tugs, 11 training vessels; aircraft stations, 57 planes; vehicular stations, 14 communication trucks (mobile radio stations) and 26 smaller trucks carrying lighter portable communications equipment.

In order to understand what type of radio operation is involved in the *Coast Guard Communication Service,* a brief description of the type and capabilities of the radio equipment installed in the various classes of stations mentioned above is necessary. *Coast Guard* radio stations, both land and mobile, can be roughly divided into two systems, for purposes of discussion only; a radio telegraph system and a radio telephone system. This arbitrary division in no way displaces the primary and secondary nets referred to above. The radio telegraph system consists of the primary, secondary and aeronautical radio stations, cutters over 100 feet in length, aircraft and communication trucks. The radio telephone system consists of radio telephone control stations, lifeboat stations, light stations, lightships, cutters less than 100 feet, tenders, tugs and smaller trucks. For purposes of inter-communication between these hypothetical systems, all stations in the radio telegraph system are capable of radio telephone transmissions.

The stations equipped for radio telegraph operate on frequencies from 2,000 kc. to 18,000 kc. and on intermediate frequencies, 200 to 600 kc., with transmitter powers from 200 to 1,000 watts. The smaller vessels in this system have, however, lower power, generally 50 or 100 watts. The stations equipped for radio telephone operate on frequencies from 2,000 to 3,500 kc. with transmitter power from 5 to 100 watts.

In addition the *Coast Guard* owns and operates a coastal telephone system consisting approximately of 1,678 miles of pole lines, 3,212 miles of open wire metallic circuits, 45 miles of aerial and underground cable and 720 miles of submarine cable. This wire system is an important part of the communication service and supplements the radio system along the entire Atlantic seaboard and parts of the Gulf and Pacific coasts.

In connection with its duties pertaining to preservation of life and

This 38-foot picket boat of the Coast Guard is equipped with radiotelephone.

Upper left: Coast Guard Communications truck with collapsible antennae. Right: Radio operator on duty in a Coast Guard plane. Note parachute strapped on back.

property at sea and the construction, operation and maintenance of all aids to navigation, the *Coast Guard* operates two specialized radio services other than the communication system described above. These are the marine radiobeacon system and the navigational radio direction finding stations, composed of 172 radiobeacons and 21 direction finding stations. These services have been in operation for years and are well known in the maritime world. They are important examples of the function of radio in the *Coast Guard.*

It is readily apparent that the *Coast Guard* requires a large group of highly specialized and well trained personnel to operate, maintain and, in some instances, develop the necessary equipment for the manifold purposes outlined above. To maintain the supply of skilled personnel the *Coast Guard* operates two training schools for radio operators at New London, Conn., and Baltimore, Md. All radio personnel, whether recruited from civilian life with previous experience, or selected from the enlisted ranks of the *Coast Guard,* are trained in one of the two Radio Schools. The radioman, after the required service, if he desires and shows special aptitude, may be sent to the *Coast Guard* material school at New London, Conn., for further training in maintenance and repair of radio equipment or for advanced training in radio theory to *Navy* or commercial schools. There are also opportunities to attend Navy Sound Schools and the schools maintained by the various manufacturers of specialized communication equipment, such as, under water sound equipment.

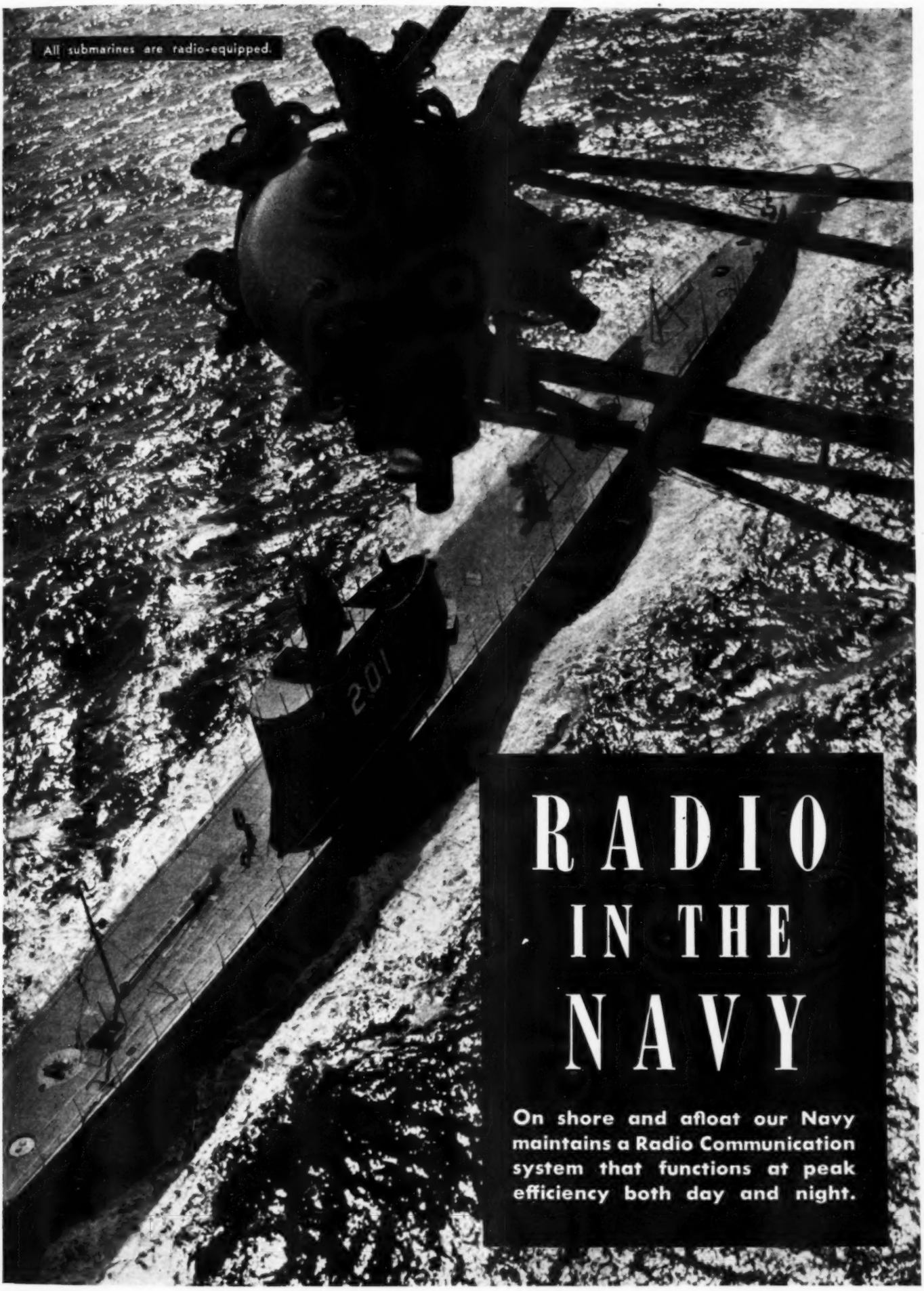
For the trained man the *Coast Guard* offers various opportunities for work in the development of equipment for the specialized duties performed by the service. The *Coast Guard,* faced with the urgent and immediate need for a large number of radio equipped small boats, pioneered in the development of the present day radio telephone equipment afloat. The first *Coast Guard* radio telephone installation was completed in 1924 on the seventy-five foot patrol boat CG-100 with a similar installation ashore at Rockaway Point, N. Y. This transmitter, as first installed, was a vacuum tube transmitter of 50 watts carrier power covering medium high frequencies from 1,700 to 2,500 kc., capable of modulated C. W. and voice transmissions. For operation by unskilled personnel the transmitter was tuned to a single frequency and then locked. Since that time, of course, *Coast Guard* radio equipment has progressed rapidly, keeping pace with the developing art. The equipment is now the most modern that industry can produce and no new fields of communication study are being neglected. Frequency modulation is used and is being investigated further with a view to improving our communications. The ultra-high frequencies are being used both for communication and control circuits. Experiments are currently being conducted, from which it is hoped, new uses and new ideas will be developed to increase their value.

The most fruitful field for service in scientific development looking toward practical application in the *Coast Guard* is in connection with aids to navigation. This field is specialized and wholly the responsibility of the *Coast Guard.* The radiobeacon system of aids to navigation, a network covering the coasts of the United States, the Great Lakes, Alaska and Hawaii, maintained and developed by the *Coast Guard,* is acknowledged to be the most complete and effective in the world. *Coast Guard* engineers worked out and developed the many technical problems in perfecting and making practicable the successful functioning of this most important aid to navigation yet devised. The radiobeacon buoy, or marker beacon, is the latest addition to this system and is for close navigation in approaches to harbors and in restricted channels. The adaptation of radio ranges (directional beacons) and exact course indication for important channels, rivers and harbor approaches (similar to glide path or blind landing equipment) are already in the realm of practicability.

It is also in the field of aids to navigation that radio control circuits have their widest application and have reached their highest development. These circuits are used to start and stop radiobeacons, fog horns, diaphones, bells and turn lights on and off. There is always incorporated in these systems a return monitoring circuit which gives aural or visual indication at the control station that the remote aid is functioning properly. The control is set up in duplicate channels so that any possible failure in one channel would not result in failure of the controlled aid. The development of these control circuits requires exhaustive tests and trial under service conditions before they can be adopted. The circuits must be as reliable as the aids to navigation which they control. It is a safety service which the mariner must be able to use with confidence.

For use in its important work in warning people in the path of impending flood or hurricane, and for moving into areas where normal communication is totally or partially disrupted, the *Coast Guard* has brought the vehicular radio station, or mobile radio station, to a high state of development. The communication truck, as it is called, is a heavy duty 4 ton truck especially powered and constructed so that it can go swiftly to the scene over highways, and still be capable of going where there are no roads or through flooded areas (up to three feet) and over rough debris littered country. The equipment installed on these trucks consists of a complete and self-sufficient radio traffic station on wheels. It is capable of maintaining continuous communication service over a long period of time on frequencies from 300 to 600 kc., and

(*Continued on page* 78)



All submarines are radio-equipped.

RADIO IN THE NAVY

On shore and afloat our Navy maintains a Radio Communication system that functions at peak efficiency both day and night.

RADIO IN THE NAVY

Battleships steam into the night. An elaborate radio network keeps them in constant touch with the fleet.

by Rear Admiral
LEIGH NOYES, USN

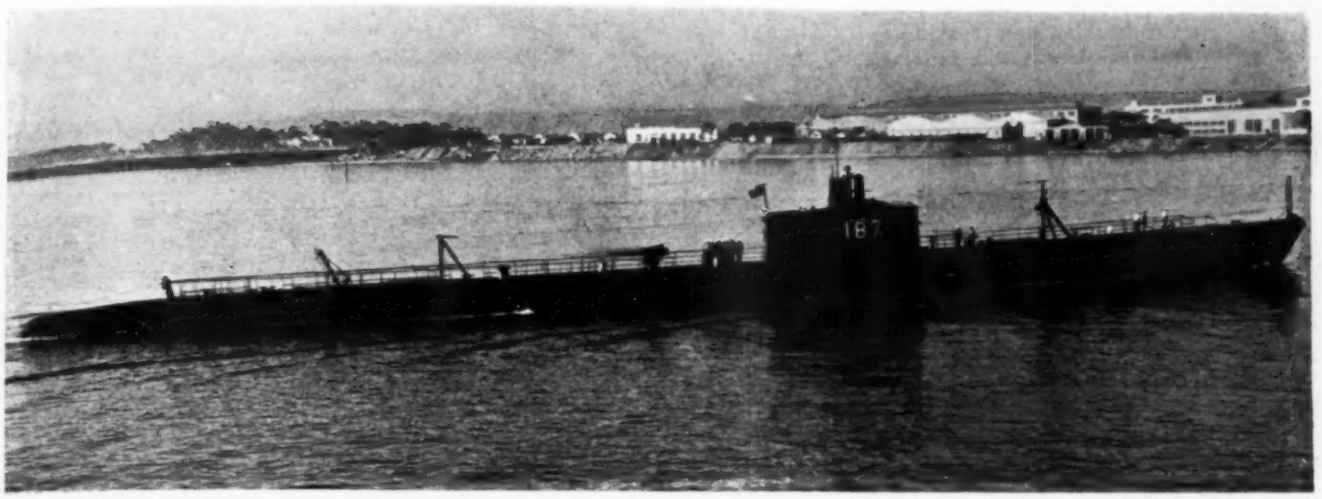
Was born in St. Johnsbury, Vermont in Dec. 1885; entered the Naval Academy at Annapolis in 1902. He served on various ships until 1914. Was Fleet Communication Officer for Admiral Mayo in 1916. Commanded the U.S.S. Biddle. In June, 1939 he assumed his present position in charge of Naval Communications. A member of the Defense Communications Board. Assisted at the rescue of survivors of the U.S.S. Macon and directed the air search made for Amelia Earhart in 1937. For services in the World War he was awarded the Navy Cross and Victory Medals.

THE development of a system of signals is one of the most important factors in the progress of *Naval* tactics. Up until the time when some method was found for communicating from ship to ship during actual action, a naval commander had been able to do little to change the course of battle once the fight had begun. He had to give his instructions to his captains ahead of time and hope that nothing would arise to lessen their value in the course of the battle. Therefore instructions had to be of the simplest and most general nature and usually consisted of little more than directing each captain to pick out the ship opposite him in the line of battle and fight it out with her on a ship to ship basis.

The first inter-ship signaling system was, of course, that by flag, in which the first really successful system was introduced into the *British Navy* by Admiral Lord Howe. Flags both by hoist to the foretruck and by hand semaphore method are still widely used for *Navy* signaling where the ships are in sight of each other and where it is desirable that the position of the fleet should not be given away by the use of radio. Today, however, radio reigns supreme as the basis of all *Naval* communications.

Practically every type of message in the *Navy* today is carried by radio. Messages from point to point on shore, from shore establishments to the fleet, and between different units of the fleet are all conducted by radio. It is a marvelous system which ties together far-flung activities from Cavite in the west to Reykjavic in the far east. The heart of this network of communication is, of course, in Washington. Here at the *Navy Department* the policies are made which control the activities of our ships and shore establishments all over the world.

The sending station from which all these orders emanate is at Annapolis, 35 miles away from the Capital. This, like all the big shore stations, has several frequencies at its disposal. It is one of five important shore stations, the others being at Balboa in the Canal Zone; Mare Island in San Francisco Bay; Lualualei near Honolulu; and Cavite in the Philippine Islands. These five stations can reach any point



USS STURGEON, modern submarine. Radio antenna may be seen strung between two supports along main deck.

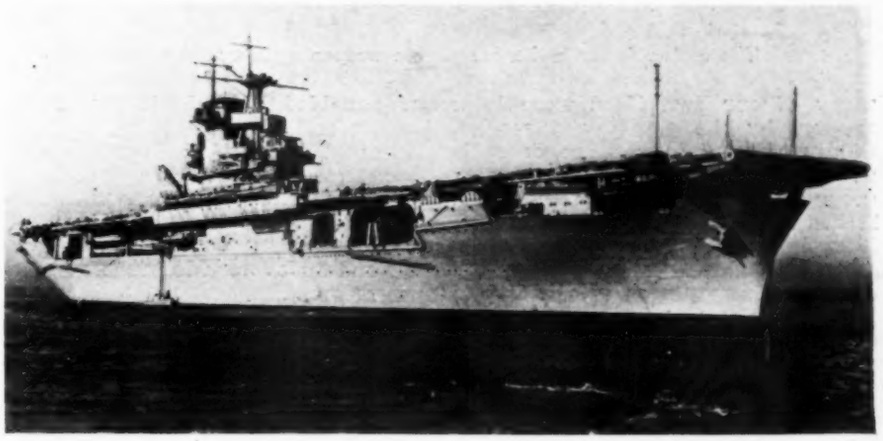
in the world. In addition, each *Naval District* has a radio station near its headquarters. These handle all the messages of the area and send them to the nearest large station for communication with points beyond their reach.

The *Naval Communication Service* of the United States *Navy* is charged with the administration and operation of all naval communication systems. These include messages carried by telegraph, telephone, radio direction finder, visual signals and sound telegraphs. Courier and postal services are included and even the care and training of pigeons. *Naval* policy provides that the communication system be maintained on such standards as will fill all war requirements, including direct communication with overseas possessions, vessels of the merchant marine and aircraft flying above the seas. It also provides for complete cooperation with commercial services that no avenue be left untouched that would give us complete coverage in times of stress.

With the present tension existing in all world capitals, the *Naval Communication Service* has taken all necessary steps to carry out the policy of the *Navy* in blanketing the country and our overseas possessions with the best service obtainable.

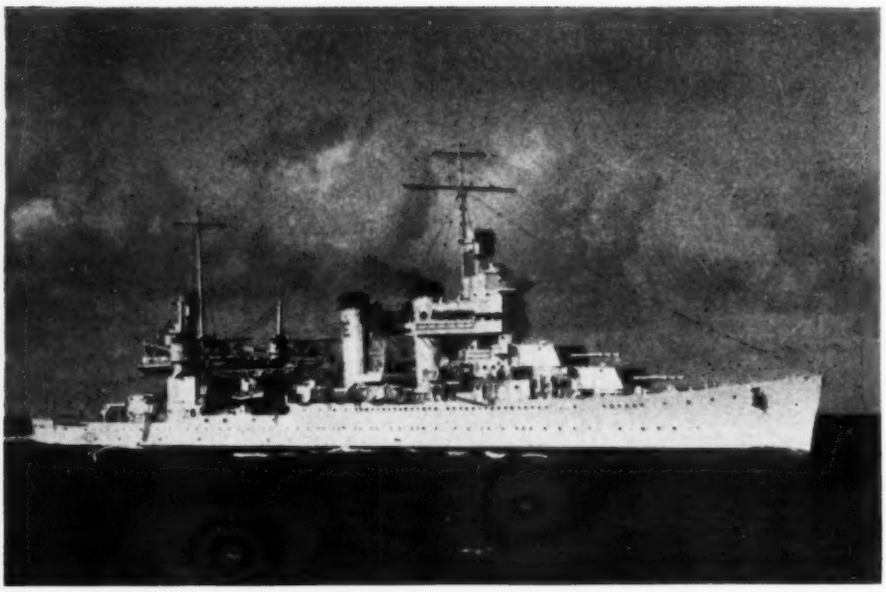
The Director of the *Naval Communication Service,* besides seeing that *Naval* Policy is carried forward, is responsible for the training of personnel in all operating procedures. He also is concerned with the procurement and assignment of radio frequencies and the preparation and effective use of codes, ciphers and tactical calls that will assure effectiveness of our naval forces at sea.

It is interesting to note that the *Navy Department* made its first radio installation as early as 1900. Since then the *Navy* has been among the leaders in this field, quick to adopt new methods, and anxious to improve this means of talking by air that has so startled the world throughout the present century. Invention has been stimulated by naval requirements and



This is the USS WASP, radio-equipped aircraft carrier, in action.

Sailor is receiving orders over specially-designed phone on ship.



The cruiser is fast and a formidable weapon against submarines.

many of our own ideas were later adopted by the commercial service. Officer training in the use of radio at the Naval Academy was well grounded long before the last war. It has always been the desire of the *Navy* in its radio activities to cooperate with industry and our research engineers have played a leading role in the development of vacuum tubes, duplex radio telephony, in fact apparatus of all kinds, as well as high speed transmitting and recording systems, mechanical relays and radio direction finders.

The development of radio to the high efficiency it enjoys today has made it a tremendous weapon in locating an enemy and tracking him to his doom. It was by radio that the plane which discovered the Bismarck was enabled to call for help, mark her course and speed and bring about her eventual destruction. The same has been true in many other cases in the present war, with ships and planes and submarines able to communicate with each other much as infantry, artillery, air and tank forces do in modern land engagement.

When the President moved in 1924 to establish naval and air bases on islands secured from Great Britain it was a natural boon to the *Naval Communications System,* and now with an iron ring established outside our own shores from Dutch Harbor to Honolulu to Panama, including vast numbers of smaller islands in the Pacific and on up our eastern seaboard to Newfoundland, Greenland and Iceland, through radio transmission we will be assured of the location of enemy fleets long before they can penetrate the waters that even surround these outer defenses again.

Aviation cadets at the Naval Air Station learning Morse code.

The expansion of naval communication facilities began long before the present war. The state of nerves existing in the nations of Europe throughout the 1930's was reason enough for alertness in determining not only possible, but probable things to come. Consequently by 1939 and 1940 we were able to carry out plans that had long been formulated that would give us the greatest system of communications known to man. There were, of course, hurdles to be surmounted, there were those subversive efforts that sought to bar our progress. There were shortages, there were lags in the production of vital types of equipment, but because we had prepared so well we were able to overcome difficulties as they arose and have been fortunate for the most part, for industry and labor on the whole have given the *Navy* their best efforts in producing for us the best equipment.

The size of the *Navy,* of course, governs the size of our communications establishment. The doubling in size of our fleets at sea in what is popularly called the Two-Ocean Navy was followed by a *Naval* air program that would see our aircraft six times the numbers then available. All these increases, as well as in the enormous number of auxiliary craft built and taken over from private sources, have placed a strain on our communications systems. But we are meeting each day with renewed vigor that these minesweepers and layers, oilers, supply vessels and district craft be provided with radio receiving and sending devices comparable to those existing in the fighting fleets.

Increase in traffic above normal figures is an indication of just what this new work trend means to everyone in the Naval service of communications. In the *Navy Department* itself daily messages jumped from 1,500 in early 1939 to an average that was approaching 5,000 in the latter stages of 1941. It becomes necessary under such conditions to direct as much traffic as possible to wire lines with similar increases in the telephone and telegraphic services. Telepage printer services were installed and are being increased as required. Washington, Norfolk, Philadelphia, New York, Newport and Boston were equipped with this service which took some of the load off *Naval* radio. Formerly expenditures for telephone and telegraph communications might run $200,000 annually. Now this figure has been more than tripled.

At sea the new ships are being provided with the most modern apparatus while obsolescent radio equipment on vessels long in commission is being replaced accordingly. In the case of merchant ships taken over by the *Navy* in the emergency, much of their

(*Continued on page* 80)


RADIO IN THE
MARINE CORPS
Radio Communications have helped the Marines uphold one of their many traditions, to be first on the job.
2-MF-9
2-MF-10
2-MF-4
Grumman F3F Radio-Equipped Fighters.

RADIO IN THE MARINE CORPS

Back in 1932 the Marine Corps radio equipment looked very crude compared to the present units.

by Capt. JAMES G. SMITH

Graduated from U. S. Naval Academy in 1932. Army Signal School, Fort Monmouth, N. J., in 1936, Radio Engineering Course, U. S. Naval Academy, Postgraduate School, Annapolis, Maryland, with third year at Cruft Laboratory, Harvard University, Cambridge, Massachusetts. At present assigned to Communication Section, Headquarters, Marine Corps, Washington, D. C. Amateur radio operator since 1920, with calls 9RT, W1HSA, W2IWW, W3GKN, and W6LYE. Capt. Smith is one of radio's old-timers.

IT WAS back in 1916, that the *Marine Corps* organized its first signal unit. This battalion, formed at Paoli, Penna., is the father of our modern communication units. Even before this marines were manning important radio circuits in remote places about the world. During this period, a real love for the game was essential, since the modern training facilities were non-existent. Equipment was poor and none too reliable. An operator had to be a practical radio engineer to keep his signals on the air. Modern test equipment just didn't exist. Antenna theory was still conflicting. It was up to the operator to string his aerial wires in accordance with his personal whims and intuitions. Success was measured by the ability of the hot-wire ammeter to bend its pointer on the peg. During this period radio had little or no standing at Headquarters in Washington. A self-trained operator would often find himself transferred to duty having no connection with radio.

"Modern conditions of military action demand . . . constantly increasing technical skill from fighting men. The equipment, which the force of events has introduced into the ranks, demands the gift, the taste, the habit of serving it. This is a consequence of evolution, ineluctable in the same way as the disappearance of candles or the end of sundials. The era of picked soldiers and selected crews has arrived." So stated General de Gaulle in 1934, but the *Marines* knew this in 1929 and established a communication section in *Headquarters Marine Corps* at Washington. Communicators were given an official standing, modern equipment was designed and procured, many ideas were tried and later rejected, a system of training was started. No longer did the radio operator find himself being ordered to do duty as a mess sergeant. A branch of specialists was now in the making with the *Major General Commandant* backing them up and offering encouragement.

Lets take a look at what this evolution accomplished. Modern schools were established at Quantico, Virginia, and San Diego, California. Their missions are identical—to turn out competent radio operators. Since field radio operators must still rely upon their native abilities in many cases, these courses also include electrical and radio fundamentals. Graduates are designated as "Communication Personnel" and this distinctive title follows throughout their service career.

Becoming a radio operator in the *Marine Corps* is not a complicated or a hit and miss proposition. Let's get down to facts and consider a specific case. A marine upon enlistment finds himself undergoing "recruit training." He has become a "boot" in the lingo of the service. During this training he is given an opportunity to take an examination for special training in radio. The qualifications required for selection are an inherent interest in radio and satisfactory markings in the qualifying examinations. Young men with high school education, or its equivalent, normally experience no difficulty in passing the academic portion of the examinations.

Upon completion of recruit training marines selected for enrollment are transferred to Quantico, Virginia, or

San Diego, California, for a course of instruction requiring about twenty-one weeks of intensive training in radio subjects. All instruction is by means of resident classes. These schools are in operation continuously throughout the year.

At the present time, entrance examinations are being given at Marine Barracks, Parris Island, South Carolina, Marine Corps Base, San Diego, California, and Marine Barracks, Quantico, Virginia. Candidates examined at Quantico include members assigned to *Marine Corps Aircraft* units. These examinations consist of two groups of tests. One group is termed "Educational" and the other "Specialty." The former includes arithmetic, spelling, English, and a General Classification Test. The latter includes two code aptitude tests specifically designed to measure the candidates ability for radio code reception.

Having passed successfully the above tests, the twenty-one weeks' training now commences. The time is divided and sub-divided into weeks and class periods. Each training week consists of five days, and each day consists of eight class periods. A class period is forty-five minutes. In addition to this regular daily instruction, all students attend evening study periods of an hour and a half on all days of instruction.

The subjects included in the curriculum are as follows:

(a) International Morse Code, Sending and Receiving.

(b) U. S. Naval Radio Operating Procedure.

(c) Manual Printing and Touch Typewriting.

(d) Direct and Alternating Current Electricity.

(e) Radio Frequency Circuits and Radio Vacuum Tubes.

(f) Marine Corps Field Radio and Telegraph Equipment.

(g) Calisthenics and Supervised Athletics.

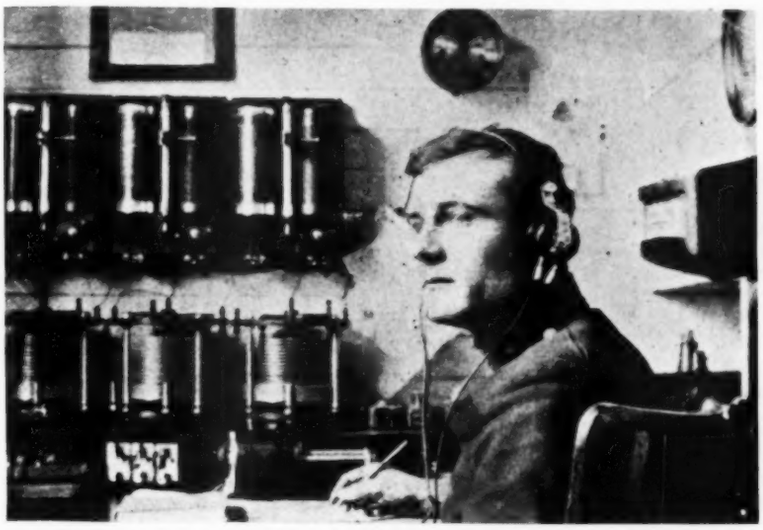
The minimum requirements for graduation are as follows: The ability to receive non-pronounceable alphabetical letter and incoherent English word code at twenty-five words per minute. The ability to send this same material at eighteen words per minute. In all other subjects, a student must obtain a passing mark of 70% in the final examinations.

Upon completion of the training and attainment of the graduation requirements set forth, a student is granted a certificate of graduation and awarded a diploma. The certificate is placed in the student's service record book and this becomes an official part of his service record.

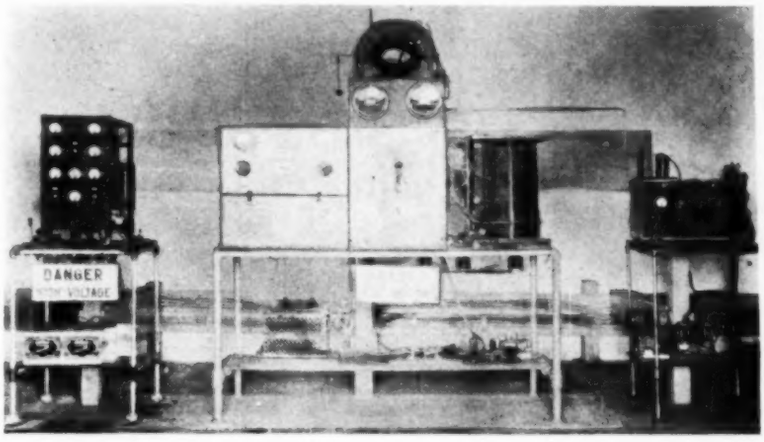
In general, results of the entrance examinations employed for selection of students indicate that approximately 15% of the candidates examined are selected for training in radio. Of those enrolled, about 75% complete the training and receive certificates.

These graduates constitute a high

Early Marine Corps Radio Equipment

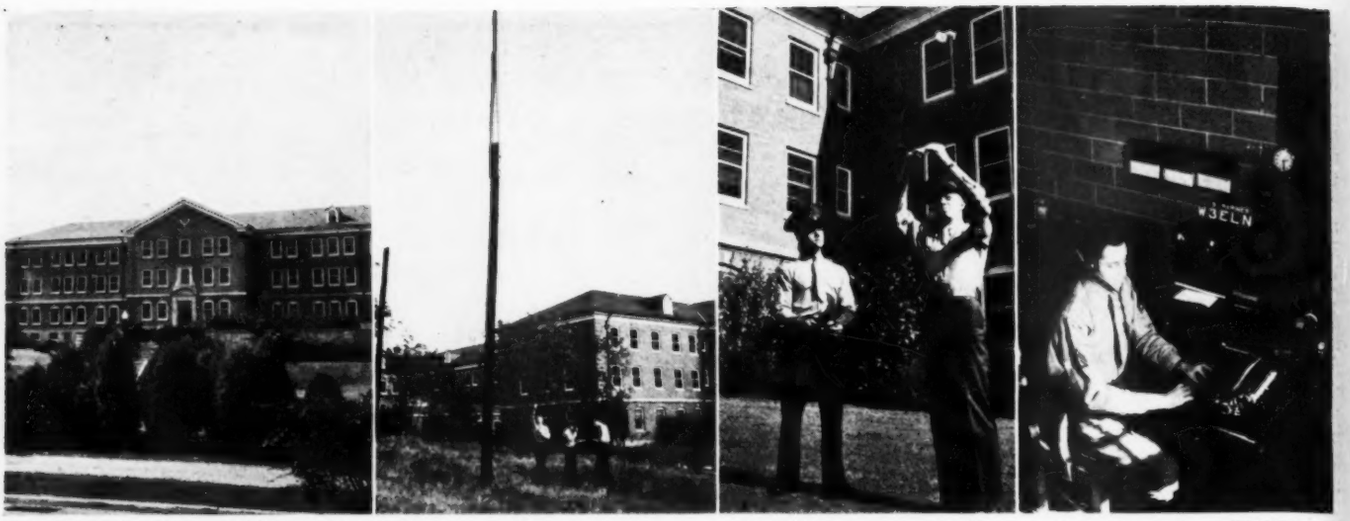


Crystal detectors and spark transmitters were tops back in 1913.



Exposed wires were a constant source of danger to the operators.

Advanced class in code instruction simulate radio net procedure.



"G" Barracks, home of Marine Ops. Erecting a 75 meter antenna. Assembling antenna feeders. Copying traffic at W3ELN.

type of young man, and have a sincere interest in radio and communication duty. The course of training has exacted intense application and hard mental effort for over five months. These radio operators are then transferred to combat units of the *Fleet Marine Force,* or to naval radio stations for further training in high speed naval nets. Among the many naval radio stations that are or were operated by the *Marine Corps* are those located in Shanghai and Peiping, China, in Bermuda, Iceland, Trinidad, and other places throughout the world. Exceptionally fast and accurate operators are assigned duty at *Radio Central* in Washington. Here is the Navy's nerve center in operations. Operators are also assigned to duty aboard many naval vessels. A *Marine* operator must be truly versatile in all of his work.

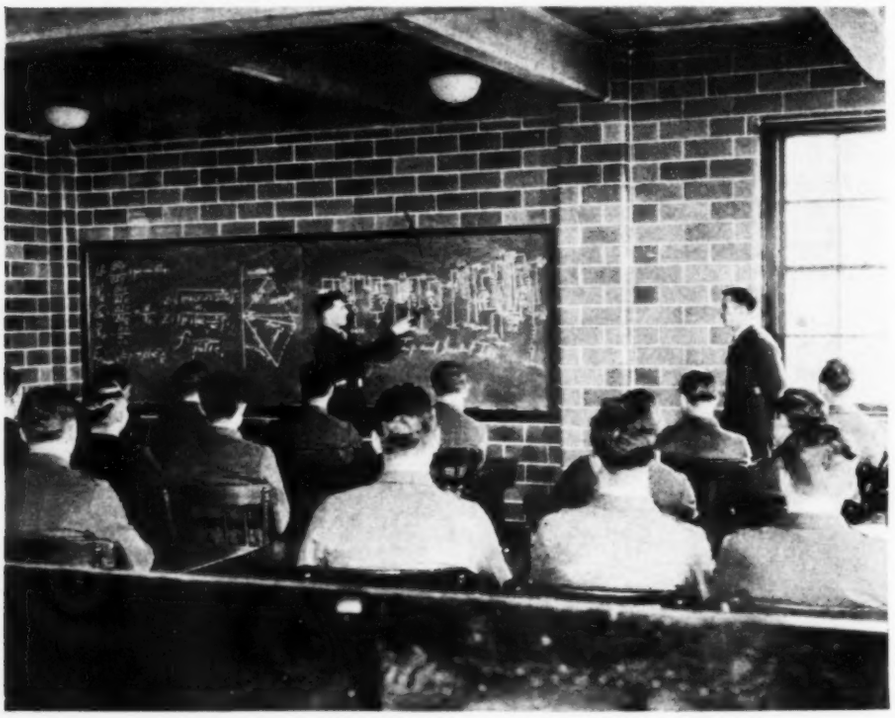
Careful records are kept on each and every radio operator and to those who stand out in front in their abilities additional schooling is given. Fifteen or more are continuously under instruction at the *Naval Radio Material School.* This school is a training activity of the *U. S. Navy* and is located at the *Naval Research Laboratory,* Bellevue (Anacostia), D. C. This course provides advanced training in radio material and maintenance.

Entrance examinations for this school are tough. Only those men who have kept alive their keen interest in radio and desire to learn more about theory and modern equipment are successful in completing this eight months' course. The training provided during this period is very comprehensive. It involves the practical care, adjustment and operation of the more intricate types of electrical and radio equipment employed by the naval service. Types of equipment covered include those used in high power naval radio stations, naval aircraft, and radio direction finding stations.

Graduation from this school, a rung in the ladder of promotion, finds more specialized radio assignments, more responsibility, and more stripes on the sleeve for marines.

Today, the most special of these specialized jobs is that of performing duty in connection with that secret and new piece of gear known as the "Radio-Locator," or air-warning device. For here again, the true versatility of the Marine is put to the acid test, for the equipment is highly complicated, sometimes a bit cantankerous, and can be very lethal if not handled properly! It is the most fascinating equipment yet devised.

Students acquire basic instruction in radio theory in this classroom.



The technical and tactical education of officers assigned to communication duty is a two-fold responsibility of the *Marine Corps.* Since we are a component part of the *United States Navy* with landing operations and the seizure and defense of advanced bases, one of the main missions, it is paramount that we be skilled in Naval Communications. There has been and are many occasions when we operate directly with the *Army.* In order to provide communication officers with the necessary background to perform successfully their duties the Major General Commandant assigns officers to the *Army Signal School,* Fort Monmouth, New Jersey, The Communication Officer's Course at the Infantry School, Fort Benning, Georgia, and to the Naval Postgraduate School, Annapolis, Maryland. The first two courses require approximately six months for completion. The latter course requires three years, two of which are at Annapolis and the third year is spent at Cruft Laboratory, Harvard University, Cambridge, Massachusetts. Students ordinarily selected for these courses are graduates of the U. S. Naval Academy, or hold

(*Continued on page* 84)

CIVILIAN RADIO DEFENSE

Working in close cooperation with our Armed Forces, the civilian radio nets will help protect "the man behind the man behind the gun".

CCC Radio net station

CAA Geared for Defense

Even before War with Japan, 80 to 85 percent of all air traffic was military. The CAA serves both military and civilian traffic.

by Brig. Gen.
DONALD H. CONNOLLY

Born February 11, 1886. Graduated from West Point in 1910. As Engineer, was Assistant Chief of Staff in Mobilization of 30th & 8th Division during early days of 1st World War. After the war, served on War Department General Staff. Organized Civil Works Administration in Los Angeles. Returned to Army to command Second Engineers. He was appointed Administrator of Civil Aeronautics, in July 1940. Was made Brig. Gen. in the spring of 1941. Authority on engineering and administration.

COMMUNICATIONS for control of vital air transportation facilities are assuming more importance every day the emergency lasts.

Teletype, radio and telephone, which made possible communications fast enough to use in connection with rapid transportation by air, are all maintained by the *Civil Aeronautics Administration,* and are all under constant use in the military flying that is today a major portion of the traffic along the airways. Expansion of these facilities is being carried on at a pace more rapid than usual, and the system will benefit from the emergency much as aviation in general is getting a stepped-up tempo.

Two temporary emergency committees are included in the coordination of weather and communications facilities for the benefit of military and commercial flying. One is the *Defense Meteorological Committee,* headed by F. W. Reichelderfer, head of the *Weather Bureau,* and the other is the *Defense Communications Board.* Representatives of the *Civil Aeronautics Administration* sit on committees of these organizations along with representatives of the *Weather Bureau, Army, Navy, Federal Communications Commission* and other government agencies.

These boards co-relate much of the weather services and communications necessary to handle traffic along the 32,000 mile network of the nation's airways, and, since the airways are the business of the *Civil Aeronautics Administration,* the problems usually come home there to roost.

An important part of the job is estimating in advance the increases that are to be expected in airway traffic. In a five-year advance estimate, the Communications Division, headed by Eugene Sibley, listed the air carrier operations as about 55 per cent of the traffic to be expected, with the Army and Navy together contributing 39 per cent of the traffic. In August, military traffic indicated the inaccuracy of this estimate by accounting for 124,939 operations, while the air carriers had 98,600 operations, and the itinerant pilots 34,000. September figures supported this trend when the military accounted for 163,603 operations, the Air Carriers for 98,600 (sic) and itinerants 30,900.

That, however, is still an inaccurate picture of airway traffic as it now exists. Before war with Japan 80 to 85 percent of all airway traffic was military. In addition, it must be considered that a flight of military planes in formation is considered only as one operation, even if there are 18 or 27 planes in the group. Still further, there are numerous flights by military planes which are not along the airways, but for which the services of the *Civil Aeronautics Administration* communications facilities are useful.

Thus, the defense angle is inextricably connected with the communications system built up for peacetime air travel use and is necessitating its steady expansion. The cooperation with Canada on weather and communications service continues, and increases, until Canadian and United States airways weather and communications services can almost be considered as one big unified system, using the same methods and operating in the same frequency bands.

The very heart and soul of this system is the radio. Only radio is fast enough for communication between airway traffic control and airplanes in flight, and no part of the system is as important as this, especially in conditions of instrument flying. Recognition of the importance of this communication came recently when the *Civil Aeronautics Administration* changed the classification of the men who work in the Airway Communication Stations from "Communications Operator" or "Aircraft Communicator."

Managing traffic along the airways calls for meeting and solving frequent crises, mostly concerned nowadays with bringing planes in for landing at their destinations safely. Doing this job safely on an airway crowded with planes going three and four miles a minute is a job that sometimes takes precedence over all other communications with the pilot. It is necessary sometimes to interrupt the broadcast of weather information either regular or special, to talk to pilots who are flying instrument, and line them up for safe approach to the field, and ultimate safe landing.

Crowding of channels however has necessitated supplementary facilities such as teletype and relatively new interphone system, both of which are growing remarkably. Increasing traffic recently necessitated an entirely new teletype service, and still further changes are planned in the picture.

Circuit A, which consists of about 31,337 miles of line service leased from the telephone company, carries the hourly, and special weather broadcasts, along with NOTAM, the pilot's code for Notices to Airmen. These notices relate to changing conditions which the pilot should have even while he is in flight, such as inauguration of new facilities, discontinuance of facilities, changing conditions of fields, repairs to fields, restricted areas, temporary use of sections of the airways for military maneuvers and similar variations from normal operations.

Schedule B provides means for handling aircraft movement and the other information required in airway traffic control, including movement of planes especially under instrument conditions. It also is leased service from the telephone company, and totals 13,445 miles.

Schedule C was instituted the first of September to take some of the load off Schedule A, and is used to send out meteorological information other than the hourly forecasts. Meteorologists of the *Weather Bureau* and the airlines use the information on the schedule for making weather maps. It includes upper air and radiosonde data, and carries the three-hourly and six-hourly synoptic reports and forecasts, and air mass analyses. There are 24,453 miles of this schedule, and the lines are leased from the *Western Union.*

Interphone service began within the confines of the airport, but has now expanded to cover the airways, with 4,804 miles of leased wire in use. Eventually interphone will supplant Schedule B, according to the long-

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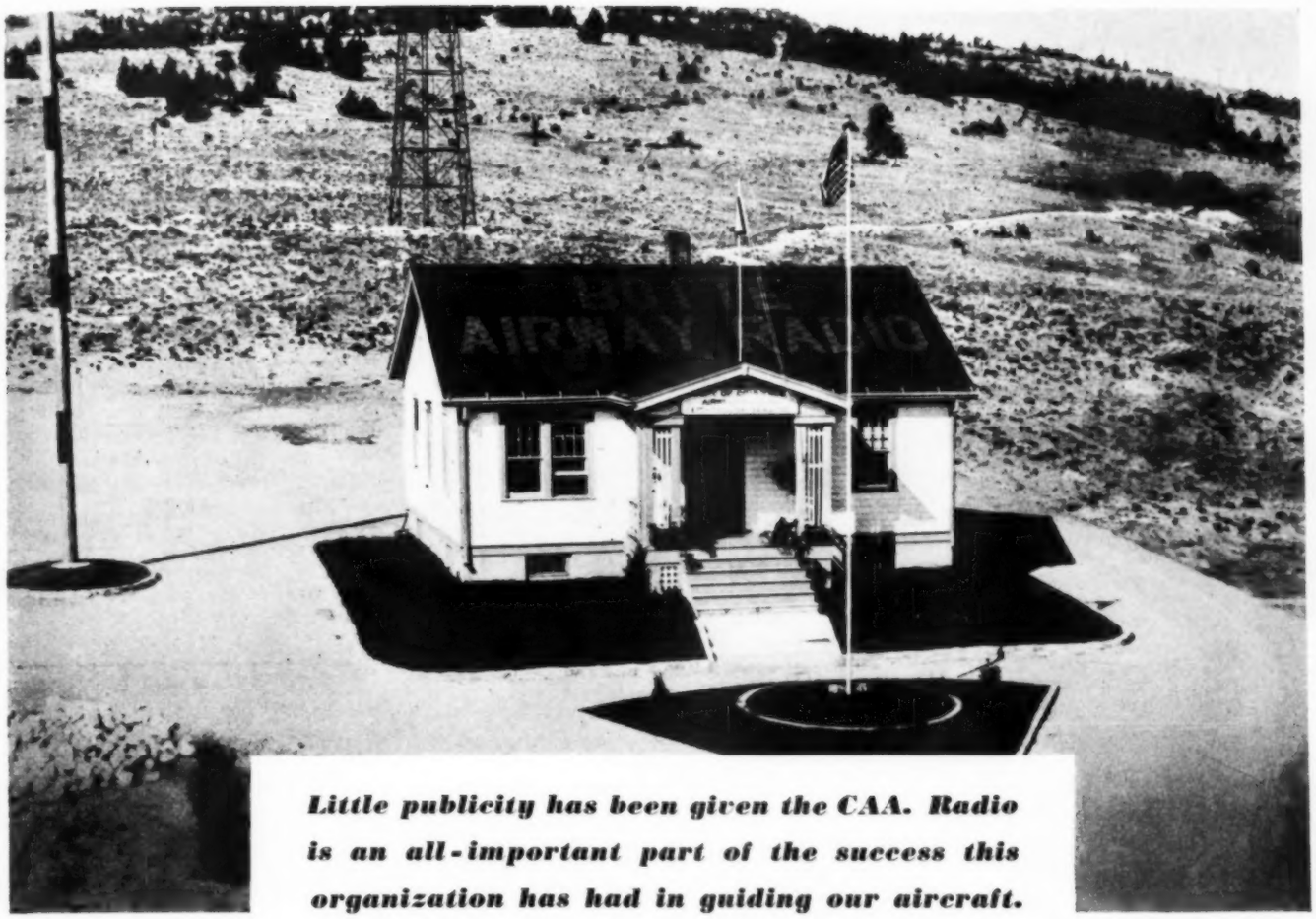


Little publicity has been given the CAA. Radio is an all-important part of the success this organization has had in guiding our aircraft.

CAA RADIO EQUIPMENT

by

THOMAS B. BOURNE

Born January 9, 1896, Baltimore County, Md., attended Maryland University. Entered Airways Division, Bureau of Lighthouses, Department of Commerce, as Airway Extension Superintendent on April 15, 1927. Was one of the first of the group that laid out the original airways. Served as District Manager at Newark 1932-1934, and successively served as Assistant Chief of the Airways Engineering Division, Chief of Airways Engineering Division and now holds the post of Director of Federal Airways.

OVER a period of years the CAA has established and maintained a complete network of radio facilities to serve as aids for air navigation. The CAA is continually extending these facilities as well as establishing new types of aids to take care of corresponding developments and growth in aviation.

The existing radio facilities established and maintained by the CAA comprise radio ranges, UHF marker stations, airport traffic control stations, transoceanic communication stations, instrument landing systems and intermediate frequency localizers.

The radio range stations are, for the most part, of the low-frequency type (200 kc. to 400 kc.) and utilize the well-known four-tower radiating system to produce two intersecting figure-8 radiation patterns. The areas of intersection of these two patterns comprise the so-called "on-course" signals or "legs" of the range. By controlling the magnitudes and phases of the currents to the various towers, it is possible to orient these courses in almost any desired direction. These towers are fed with unmodulated r.f. energy keyed with conventional A and N signals. A fifth tower is located symmetrically with respect to the other four and is fed with r.f. energy differing in frequency by 1,020 cycles per second from the energy fed to the other four towers.

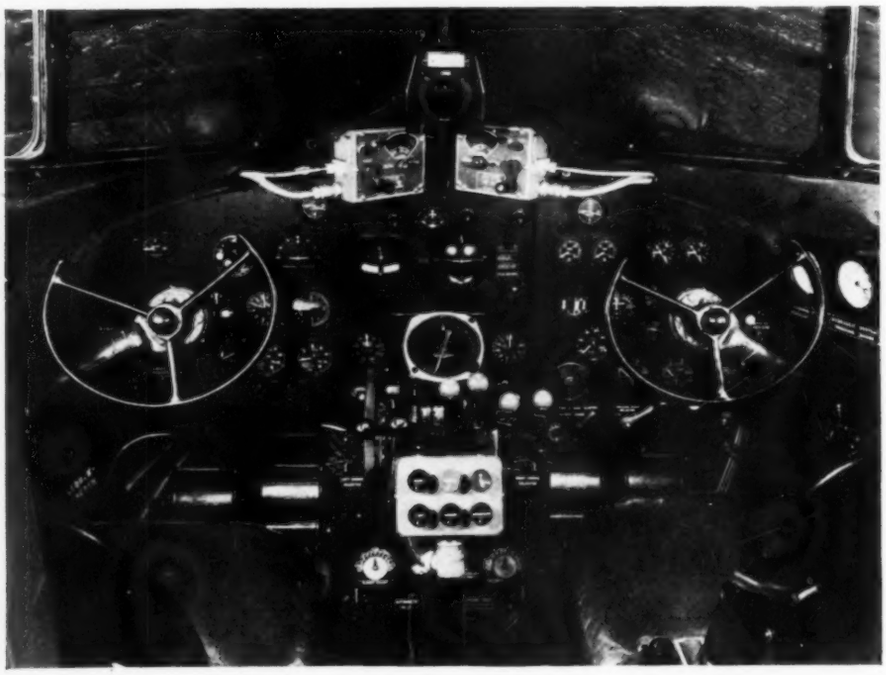
The simultaneous reception of these two frequencies by a receiver provided with a linear detector results in a beat note of 1,020 cps. Due to the interlocking of the A and N signals, the "on-course" sounds like a continuous unkeyed tone of 1,020 cps. The deviation of the aircraft to either side of the "on-course" zone will result in a preponderance of A or N signals.

Provision is made in the transmitter equipment to modulate the r.f. radiated by the center tower with voice so as to provide a convenient means for the transmission of weather and other information of interest to a pilot. The relative magnitude of the r.f. energies fed to the center and corner towers are so adjusted that the resultant beat note in the receiver represents an effective modulation of approximately 30%. The peak voice modulation is of the order of 65%. Special limiting amplifiers are used in the voice circuits to prevent overmodulation by the voice signals.

These stations have a maximum

Operator placing a weather observation report on the teletypewriter circuit.

Installation of two automatic radio compasses in cockpit of DC-3 aircraft.



power output of 400 watts and as in practically all other radio facilities maintained by the CAA, duplicate transmitters, keyers, and link relays are provided at each station to minimize outages due to failures in the equipment. In certain instances where the use made of the facility does not warrant the expense involved in a system such as that described above, stations of the so-called loop type are employed. These operate essentially on the same principles as those of the tower type except that a single r.f. carrier modulated at 1,020 cps is used and is fed to two loop radiators placed at right angles to each other. The power of these loop stations is considerably less than that of the tower type.

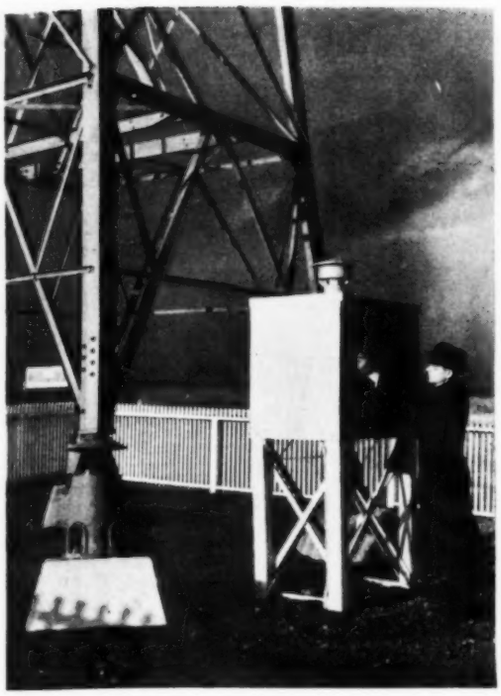
At the present time a relatively large program is in progress for the establishment of numerous ultra-high-frequency radio ranges operating between 119 megacycles and 127 megacycles. A special type of radiating system utilizing five horizontal loops mounted on top of an elevated counterpoise is used for this type of facility. The loops are so designed that the radiation therefrom is almost purely horizontally polarized. A wooden house protects these loops from the weather. A special transmission line system in conjunction with phasing units is used to transmit the r.f. energy from the transmitter to the loops. By means of these phasing units, it is possible to adjust the phase and magnitude of the currents into the various loops so as to produce the desired radiation pattern. A special horizontal loop is mounted on the aircraft to provide reception of the signals emanating from these stations.

An experimental airway utilizing such equipment has been installed between Chicago and New York and is being operated at the present time on a purely experimental basis to determine both the characteristics of the equipment itself and the functional properties of such a system. It is already apparent from the operation of this airway that the use of these frequencies reduces the problem of static interference very considerably. From this standpoint alone such UHF facilities represent considerable progress over the low-frequency ranges which are greatly affected by static.

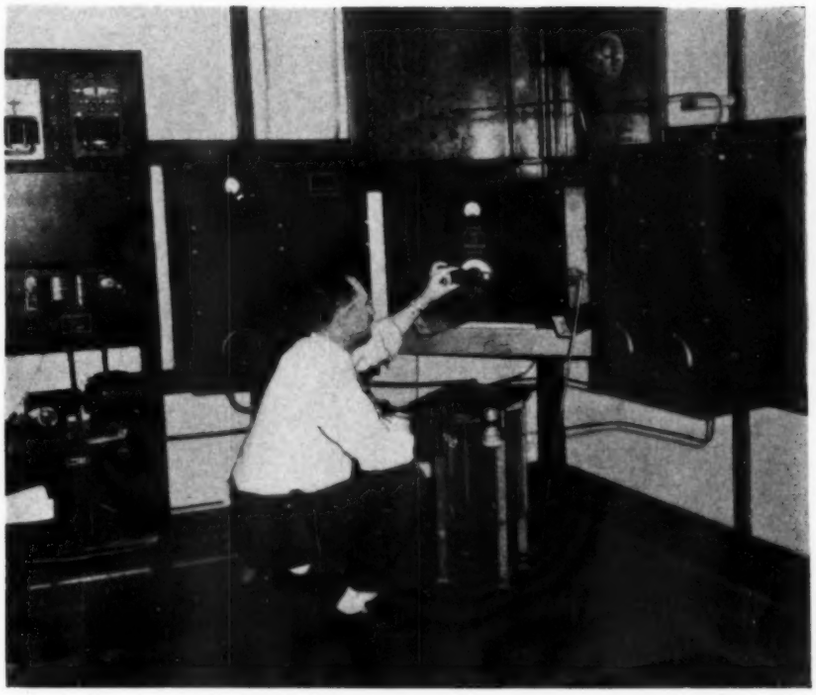
At most of the low-frequency radio range stations there are installed so-called station location markers. These markers are 5-watt dual transmitters operating at 75 megacycles and feeding an antenna system so designed as to produce a sharp vertical beam. The r.f. energy in these markers is modulated by a tone of 3,000 cps. The function of these markers is to furnish a definite and sharp indication to the pilot that he is over a particular radio range station.

In addition to these station location markers, the CAA maintains a network of so-called fan markers. These are 150-watt dual transmitters also operating at 75 megacycles and modulated by a 3,000-cps tone. Their antenna system is so designed that the station radiates a vertical beam which is roughly fan shaped (whence the name "fan marker"). Fan markers are located on the radio range courses some distance from the radio range stations and serve several purposes. For example, they are used as "fixes" in conjunction with the associated range course, whereby the pilot may determine his position and distance from a given radio range station. This determination of position is very often a part of the procedure for an instrument or "blind" approach to an airport. These markers are further utilized in the control of air traffic at congested points. In this case the control operator at the airport advises a pilot to stay within the vicinity of some fan marker until a runway can be cleared for a landing. Every fan marker is keyed by one, two, three, of four dashes depending on whether it is located on a north, east, south or west leg of a radio range.

At the present time the CAA is in the process of installing a number of instrument approach systems at various airports beginning with the *Washington National Airport.* A four-element system is used for this purpose and includes localizer, glide path



Tuning-unit at typical range station.



Goniometer at range beacon where beams are swung to their correct course.

and two marker transmitters. All of these transmitters operate at ultra-high frequencies between 75 megacycles and 110 megacycles. The two markers operate at 75 megacycles and are essentially miniature fan markers with a power output of approximately 3 watts. These markers are located along the axis of the runway to be used and on the approach side thereof. The inner marker is located within a few hundred feet of the approach end of the runway and the outer marker is located several miles away from the inner marker. The localizer transmitter has a power output of approximately 300 watts and feeds a multiple loop system designed to produce a sharp course along the runway.

The r.f. energy of the localizer transmitter is modulated by two tones, one at 90 cps and the other at 150 cps by means of a mechanical modulator. The antenna system of the localizer actually produces two separate patterns in space each modulated by one of the above frequencies. There will thus result a certain direction in which the two modulations are equal in intensity and this is the so-called localizer course. Actually, the aircraft localizer receiver uses a combination of filters and rectifiers in conjunction with a zero-center microammeter so connected that when the aircraft is flying directly on the localizer course this instrument indicates no deflection from the zero center.

As the aircraft departs from the "on-course" direction, the instrument pointer will deflect to the right or to the left, depending on which side of the localizer course the aircraft is flying. The localizer transmitter and antennas are located on the center line of the runway just off the far end thereof. The glide path is of the constant-intensity type and is produced by a 3-loop array fed by a 300-watt transmitter very similar to that used for the localizer. The glide path transmitter and antennas are located approximately 300 feet off the side of the runway and approximately 3,000 to 5,000 feet from the desired point of the contact on the runway.

The radiation pattern produced by the glide path antennas is so adjusted that if the aircraft approaches the runway by following the localizer course and if it so adjusts its rate of descent as to receive a constant signal of the proper strength from the glide path transmitter, it will be following the desired path of descent to the point of contact. It appears to be the consensus at the present time that this path of descent should be an essentially straight line but so modified at the point of contact that the angle of intersection with the runway is less than 1.5 degrees.

The shape of this glide path, however, may be modified in accordance with the results obtained from actual use of the system. Three receivers are carried by the aircraft in order to make use of this form of instrument landing system, namely, a localizer receiver, a glide path receiver and the usual marker receiver. The glide path receiver is a fixed frequency unit crystal controlled and weighing about sixteen pounds. The localizer receiver covers a relatively large frequency band and is usable for the reception of UHF radio ranges as well. This receiver weighs about thirty-five pounds.

The above are essentially the radio aids to air navigation, the establishment and maintenance of which are a major function of the CAA. The combined network of ranges, markers and instrument approach systems, represents a rather complete system to insure the safe guidance of various types of aircraft. The ground equipment forming part of the instrument landing and UHF range systems represents the very latest advances in the art of UHF transmitter design. This equipment as well as the radiating systems used in conjunction therewith have been and are being developed especially for these applications by the CAA in conjunction with various commercial engineering and manufacturing groups.

In addition to these radio aids to air navigation, the CAA has established and is continuing to establish and maintain radio facilities for communicating with aircraft. All of these transmitters installed at airports for traffic control are well-known. Although most of these equipments operate at low frequencies (278 kc.), work is being carried on at this time to supplant these equipments with others operating at ultra-high frequencies. The use of frequency modulation is also being investigated. Less known however are the stations being set up along the various seaboards of the country for collection of weather data as well as trans-oceanic communication with aircraft on the air lines operating between the United States and other countries. These latter are high-powered facilities (twenty kilowatts) feeding a number of antenna arrays designed for highly directive radiation to predetermined points. These stations operate in the 3-megacycle to 24-megacycle band, found most effective. —30—

NYA radio operators have access to station equipment and learn how to handle traffic on the air.

NYA RADIO

The National Youth Administration now has a radio network in every state but five. Students are trained thoroughly.

RADIO and radio devices are daily becoming more important to the national defense. In the forefront of the agencies and organizations working in the development of radio for national defense is the *National Youth Administration* with its far-flung network of radio shops and amateur clubs reaching every part of the nation.

One of NYA's most recent contributions to the place of radio as a weapon in national defense is the design and construction of a radio trailer, for use in emergencies wherever they may arise. Built by NYA youths employed in the NYA Regional Work Center at South Charleston, West Virginia, this trailer houses a portable transmitter, station W8UZH, fully equipped to go into action at any time.

Important is the fact that the transmitter may be operated from the trailer's own self-power plant so that it need not depend on any existing power lines or outside power supplies. A converted *Willys* Automobile engine is used to turn a 110-volt a.c. generator. The transmitter will operate from this source and put 500 watts power in the antenna. When regular power lines may be used as a source, it will put 750 watts power in the antenna. The transmitter has an input of one kilowatt, the maximum allowed under the *Federal Communications Commission* regulations on amateur bands.

The generator operated by the *Willys* engine also supplies current for the receiver, for fluorescent lights in the operating room, and for a spot light in the front of the trailer. Twenty feet of extension cord is provided so that the spot light may be used away from the car in emergency rescue work.

The transmitter is equipped to operate on both phone and code, and may operate on 20-, 40-, 80-, and 160-meter bands by plugging in the appropriate coils which are wound and mounted in a rack.

The trailer carries its own mast in compartments underneath the operating room in the chassis. Compact arrangement of the equipment makes possible the inclusion of bunks for four people, and a first aid kit with ample space for supplies.

In the field the trailer can be set up as a portable field communications headquarters. Since it carries its own power plant it may be taken to any scene of disaster and may operate free of any limitations imposed by power failures. In the event of national need NYA shops are equipped to turn out hundreds of such portable transmitters for use in maintaining the vital lines of communications.

The trailer was designed and built

under the supervision of William Stone, State Radio Engineer for the *West Virginia Youth Administration.*

The repair of old radio sets for the use of soldiers and sailors in the service is a far cry from the construction of a radio trailer but is a nonetheless important job for national defense. Few Americans could do without the family radio which keeps the events of the world within reach of your fingertips, and the young men who have entered the armed forces are average American boys. Seeing that they have an opportunity to share in the entertainment and information that are a part of the American broadcasting systems is truly a contribution to the building of morale in the services and to the defense of the nation. The *National Youth Administration* is coöperating with the *Army* and with private organizations in a number of communities in the renovation of old sets for this purpose.

An example of this type of activity may be found in Boston, Massachusetts, where a local newspaper is coöperating with the *Army* in obtaining through donation 1,500 idle or discarded radio sets from the public. All types of radios are being received, and are being repaired or their parts are being salvaged at the Boston radio shop of the *National Youth Administration.* The campaign is expected to provide about 750 serviceable sets for the recreation and day rooms of posts throughout New England. Under the plan persons who wish to donate radios will call up the newspaper, then trucks will pick them up and deliver them to the *National Youth Administration* shop, and after their reconditioning these trucks will carry them to their destination.

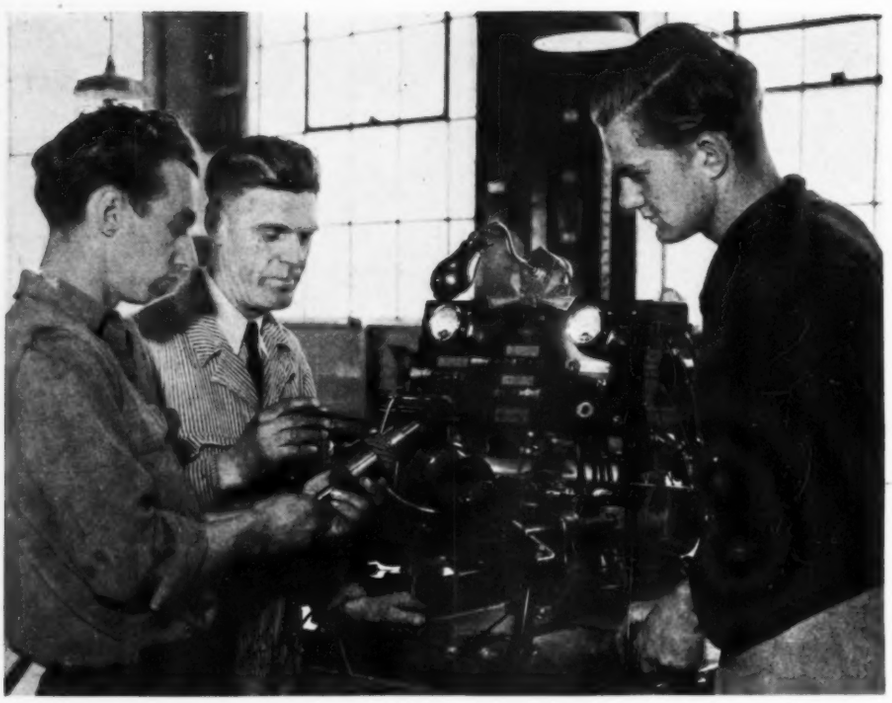
NYA now has a network of radio clubs with amateur stations in every state but five. More than two hundred stations are being operated by these youths on their own time, developing their vocational interests or delving into the fascinating avocation of radio. The tremendous importance of such a network as an aid to national defense cannot be over-emphasized, and its possibilities have already been recognized by the *Defense Communications Board* which has invited NYA to a place on Committee I, along with the *Army, Navy,* the *Federal Communications Commission,* and the *American Radio Relay League.* Thanks to the interest and enthusiasm of these youth the United States has at its disposal this extensive network of stations extending from coast to coast and from Canada to the Mexican border. It is another important link in the rapidly growing system of National Defense.

Assembly line at the Communications Center where youths essemble radios.

The supervisors of the vast radio operations of the *National Youth Administration* have constantly stressed the importance of self-power equipment for amateur stations. A dramatic demonstration of the value of having self-power equipment was given in an emergency situation in Texas in November, 1940. From November 23 to November 28 of that

This gasoline-driven motor generator is located in the back of the NYA portable mobile radio trailer.

The telegraphy table at the NYA workshop. These men are recording their telegraphy and code sending.



A foreman at the San Diego shop explains testing of generators to students.

year the Southwest was struck by a heavy ice storm. The city of Amarillo was isolated during this period. Telephone lines, power lines, and normal radio facilities were blacked out. At this time J. B. Redfearn, Supervisor of the NYA Radio Project in Amarillo, obtained the assistance of the Amarillo *News-Globe* and several prominent citizens in collecting batteries and other equipment to place his radio station on the air.

For 24 hours the station was operated solely on portable batteries. When these were consumed, the *Western Union* sent a portable generator from Dallas which continued to furnish power for the work. Messages were sent and received for *Western Union,* the railroads, public utilities companies, and individuals. Amateur radio was the only means of communication in or out of Amarillo. The NYA station was still on the air Thursday, after continuously operating from Sunday afternoon—a stretch of 96 hours, made possible only by emergency power supplies.

Another important feature of the NYA amateur system is the formation of radio clubs. While amateur stations operated by individuals certainly do have important contributions to make in emergency situations, such stations are limited by the human limitations of their operators. Club stations, such as those operated by NYA youth, can on the other hand operate on a 24-hours-a-day basis with members taking their turn at the phone or key to aid their operating.

The NYA radio network is also making a contribution to defense in other ways. There is a current demand for qualified radio operators. The *U. S. Maritime Commission* has asked NYA to assist in securing youth, physically fit and with amateur operator's licenses, to be trained at Gallups Island, Boston, Massachusetts, as ship radio operators. A steady flow of NYA youth is going from the projects into this type of work, doing their part to strengthen America. Recently the British government sent out an appeal for technical workers of several types, including radio mechanics and operators. Numbers of NYA youth responded to the call and are at present serving in places of responsibility in the Battle of Britain.

Membership in NYA radio clubs is not limited to young men anymore than responsibilities in national emergencies are limited to men only. Recognizing that there is a place for young women in national defense jobs, girls as well as boys are obtaining experience in the field of radio through the *National Youth Administration.* More than a year ago 25 NYA girls at Brenham, Texas, formed what is believed to be the first exclusively all-girls' amateur shortwave radio club in the United States. Two months after the club was formed most of the girls had reached a receiving rate of eight words per minute. Supervision is furnished by a young woman radio engineer with several years of technical experience in the field of radio.

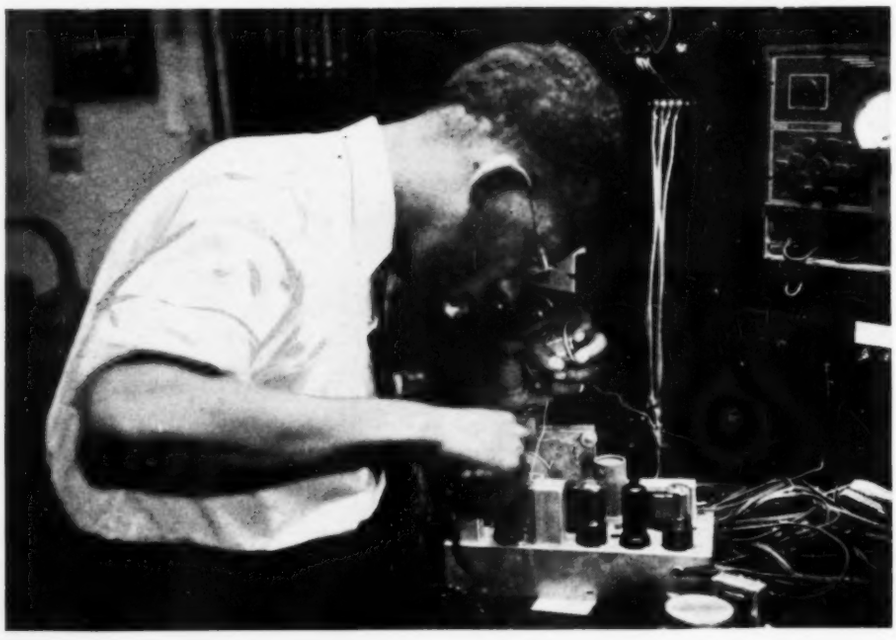
NYA radio projects over the country employ approximately 6,000 young men and women. Half of these are working in specially designated defense shops where they will receive intensive experience and training planned to move them quickly into jobs in defense industry. All are doing productive work for the benefit of governmental and public agencies. Equipment is being built for such federal agencies as the *Alcohol Tax Unit* of the *Treasury Department,* the *Immigration and Naturalization Service* of the *Department of Justice,* the *Federal Communications Commission, Civil Aeronautics Authority,* and *United States Forestry* and *Indian Service.*

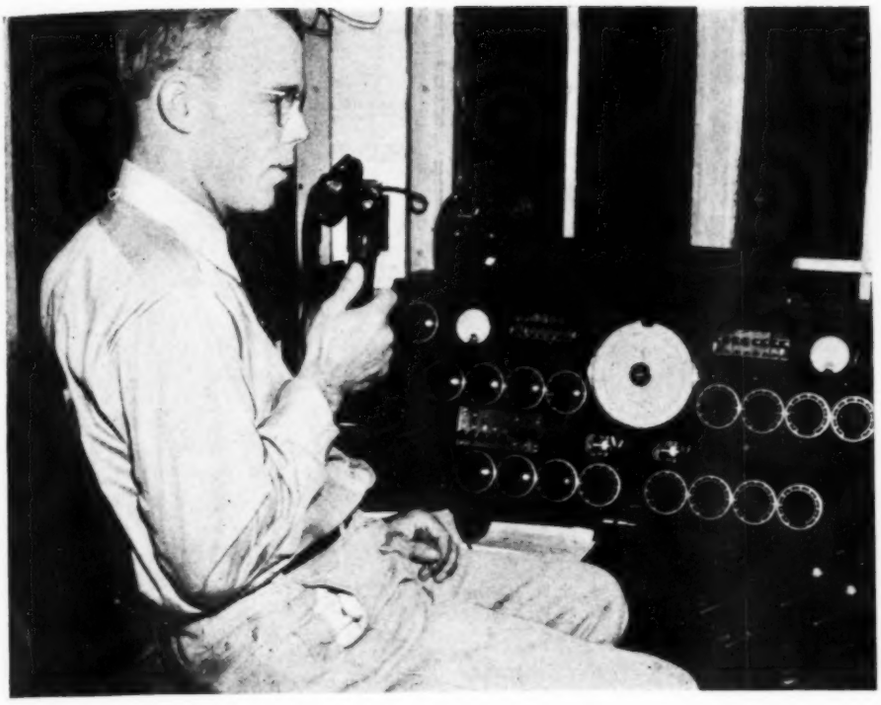
Such products as inter-office communicators, public address and fire alarm systems have been turned out for the benefit of local communities and schools. The work experience gained in this type of work will be valuable in holding down jobs in radio and allied defense industries.

One type of equipment produced in NYA shops which may prove of immense value in national defense is the two-way transmitter-receiver built for use in fighting forest fires. This project has been particularly important in New Hampshire where NYA youth workers have built equipment for one or two individual fire-radio networks,

(*Continued on page* 85)

Student wiring a 5 tube superhet receiver at the famous NYA Workshop in N. Y.

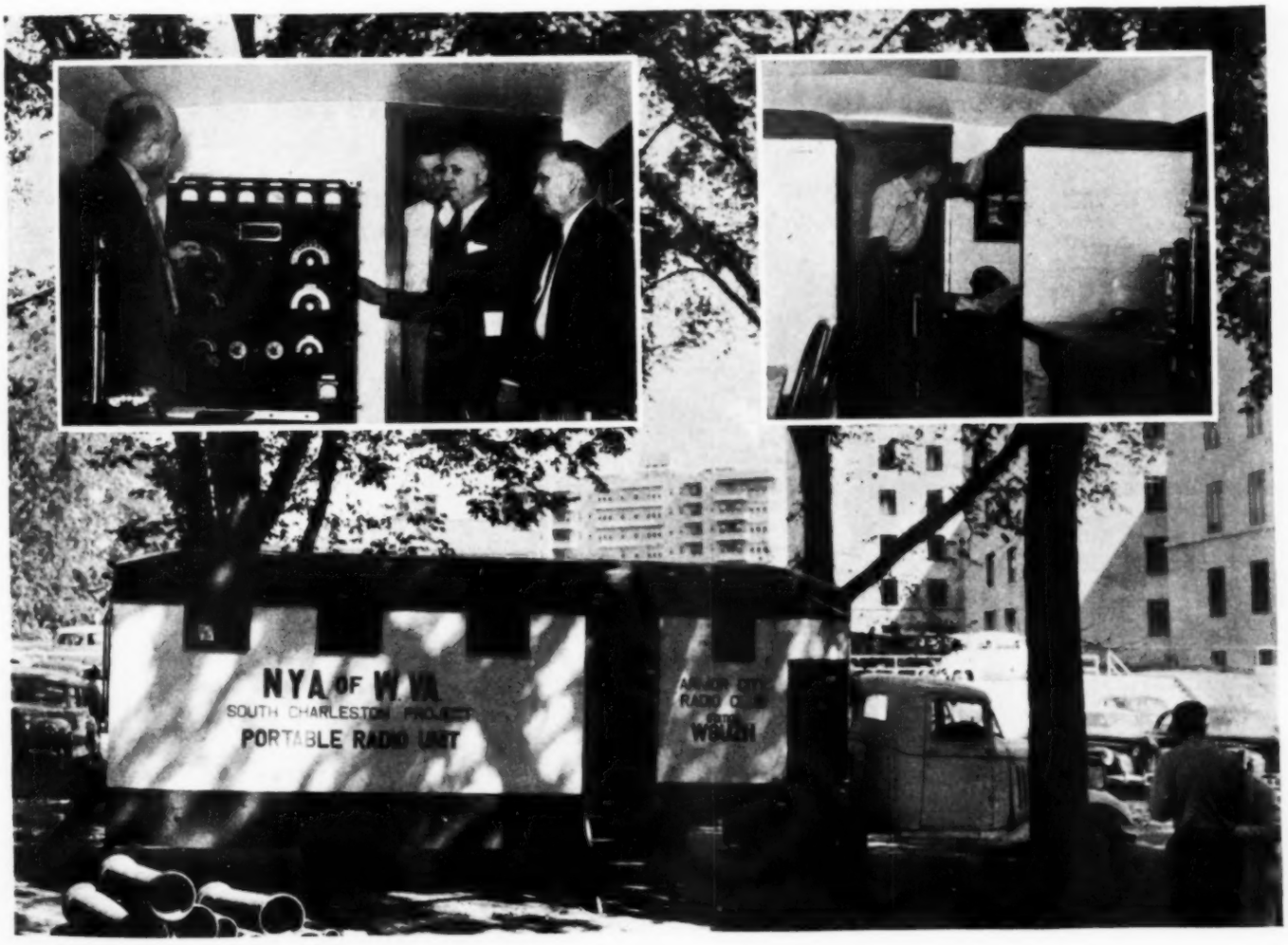




A former student of the National Youth Administration at the radio control panel at the Municipal airport located in Ft. Worth, Texas.

Erecting 75 ft. antenna for NYA station installed at Quoddy Village, Maine site.

Below: One of the most elaborate of all radio-equipped mobile units is this one built by NYA students. The huge trailer is completely outfitted for every convenience for the radio operators. Note bunks. Government officials inspect the interior of W8UZH.



Amateur station W2OEC, installed at the Signal School, Fort Monmouth, operated by the students.

Amateur Radio in Civilian Defense

The functioning of civil defense organizations is entirely dependent upon modern radio communications.

by F. E. HANDY

Comm. Mgr. ARRL

Came to the ARRL in 1925 from Westinghouse. Graduated from the Univ. of Maine. Has served the League as comm. mgr., organizing and supervising traffic nets and trunk lines for the past 15 years. In his charge also are the affiliated clubs and the extensive ARRL field organization. He designed the League's first HQ station, W1MK, and the present Maxim Memorial station, W1AW. The ARRL Emergency Corps, founded in 1935, has become the nation's first line of emergency communication, capable of meeting any problem that might arise.

THE radio amateur is to be found everywhere in the defense picture. It appears that there are something over 10,000 amateurs now in the Army or the Navy or in closely-allied civil agencies engaged in defense activity.

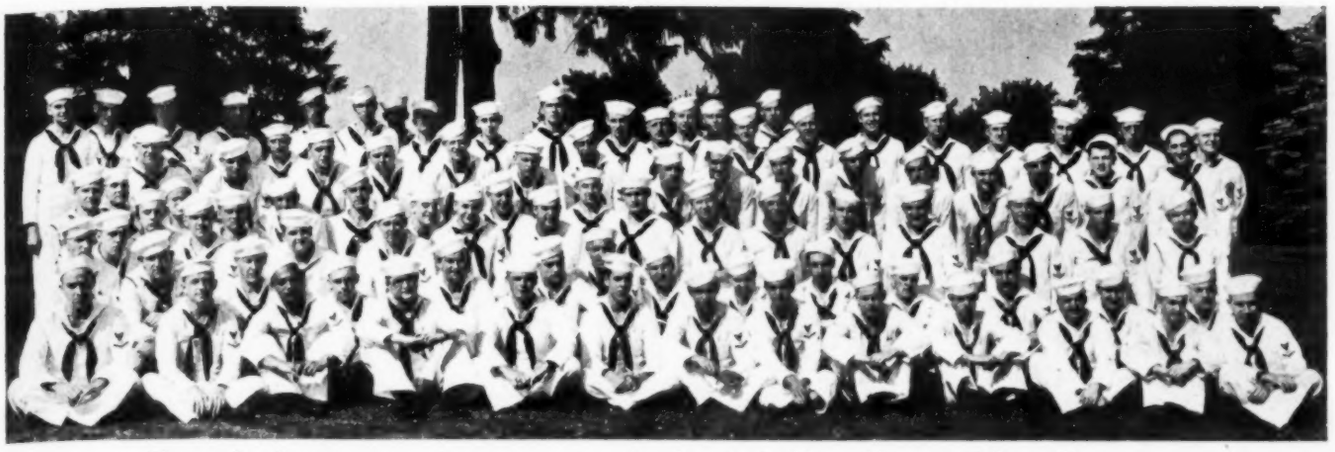
Yet these 10,000 radio amateurs represent possibly only a quarter of the active licensed amateur operators of the United States. For reasons of age, physical condition, sex or occupation the remaining three-quarters still follow more or less their normal habits of living. As time goes on, some thousands more undoubtedly will be called into military service or will fill some of the many research, operating and technical openings the *League* is constantly being called upon to fill.

But a substantial portion of amateur radio, including many of the most skilled amateurs, will continue to live in their home communities, work at their old jobs and carry on as ordinary American citizens. It is these amateurs who will provide the nation with its civilian defense emergency communications reserve, just as the amateur body has long been the one indestructible communications link in time of natural disaster.

The plans for creating a comprehensive civilian defense auxiliary communications system based on amateur facilities are, at the time of writing, in process in the interested defense agencies, chiefly the *Office of Civilian Defense*. In essence, these plans are based on the conversion of existing amateur facilities to local and regional defense needs. Because of the great differences in these needs between various sections of the country, the plans will provide sufficient flexibility to fit varying local conditions.

There is really nothing very new in all this, so far as the amateur is concerned. He is accustomed to dealing with emergencies. The conversion of amateur networks into civilian defense units can in some cases be accomplished by nothing more than a change of name, for the existing organization created for disaster-relief communication is designed to fit almost any emergency need—including war.

The importance of the amateur in this defense work is very great. It goes without saying that the function-



Thousands of amateur reservists are now on active duty in the Navy. Here are 91 licensed operators.

ing of civil defense organizations is entirely dependent upon communication. Normally these organizations will depend on the telephone system; it is fast, private, and there is a telephone in just about every house. But the very circumstances that may make the civilian defense preparation necessary are almost certain either to take wires out or to place them under the handicap of a severe overload. That is where amateur radio comes in. Then, too, there are many places where telephone and telegraph wires don't reach—isolated dams, islands and hilltops—and rooftops!—for instance. And radio is the only feasible means of communication with moving vehicles and mobile relief units.

In these circumstances the use of radio is imperative. Moreover, amateur radio is the logical source of such reserve communication facilities. The enormous demands of the military for radio materiél make it hopeless to secure vast quantities of transmitters and receivers for the less urgent civilian need, but we amateurs supply our own equipment, and what we don't have we can fabricate out of component parts in a few hours' time.

The use of amateur experience, facilities and frequencies is, therefore, the logical answer to the problem. I am gratified to report that the authorities are coming to recognize this fact. That is why the ARRL is urging all amateurs to register the availability of their apparatus and services, so that they may be fitted into the maturing plans.

As these ideas take form we are expecting that the existing low-frequency amateur networks, in general, will remain more or less intact. The AARS nets, the ARRL Trunk Lines and their associated sectional feeder systems, the numerous specialized disaster-relief nets—these will probably continue to grind much as before, their grist the growing volume of trainee traffic, now being augmented by the creation of a hundred traffic stations in USO centers around the country. These nets could serve in time of defense emergency, too, providing long-haul jumps blanketing the nation, if they were ever needed for that purpose. But in addition it is apparent that there will be required a vast number of local systems dealing with particular needs. These can be grouped as follows:

(1) Statewide auxiliary communication nets on behalf of those civilian defense agencies which are of statewide scope, operating on the customary traffic-handling frequencies. These nets will provide communication between the state capitals and the major cities of the state. The stations, in most instances those of individual amateurs, in some supplied through coöperative effort, will operate in connection with the state defense councils, providing parallel channels to replace wire lines when they are broken or relieving them when they are overloaded. In addition, there is need for special nets serving separate agencies. The state guards, for example, have no radio facilities of their own, and their local units require reliable contact with the state headquarters.

The state police, as another example, even though themselves radio-equipped, may lose their facilities or find them overloaded at a critical time. Parallel systems connecting the headquarters with outlying barracks and stations have been formed in some states and others are in process of organization. The same need exists for other centers concerned with medical services, hospitals, public health, evacuation, examination of water supplies, control of forest fires, and so on. In

(*Continued on page* 82)

Amateur radio operators were ordered to cease transmissions on the evening of December 7th on a temporary basis as a result of our entrance into the war. This was necessary in order to organize the various nets on a war footing. Certain amateurs will be permitted to operate, according to latest plans of the FCC and the UHF nets will be placed into service at the most strategic positions. Ed.

Radio amateurs examine a modern gasoline-driven generator for emergency use.

CCC NETWORKS

Advanced enrollee-student operating the CCC District Net Station S-223.

CCC radio students working at construction projects at the camp school.

The CCC radio networks have grown steadily since 1933. Students receive instruction in every branch of radio and become specialists.

by

STEPHEN C. MANNING, Jr.

His interest in radio dates back to the horse-and-buggy days of wireless in the early 20's when CW was just beginning to supplant the old spark "rock crushers." His radio activities in the CCC dates back to the start of that organization in 1933. During its formative years he joined the staff of the authorized weekly CCC newspaper. He was able to provide services to CCC radiomen by carrying schedules and data about their stations in the columns of "Happy Days," official publication of the CCC net.

CIVILIAN CONSERVATION CORPS enrollees in camps deep within the mountainous forest regions of the West, in camps scattered through the pinelands and farming areas of the South, in camps dotting the Great Plains and arid reaches of the Southwest, are contributing to the national defense effort, and to the efficiency of their own organizations as well, by studying radio operation and maintenance, and undergoing training as special radio crews to aid in fighting forest fires which often roar through the big timber forests.

Since the CCC was inaugurated back in 1933, the use of radio for intercamp communication has steadily grown under the wise leadership of U. S. Army officers assigned to CCC administration. A number of districts in widely scattered areas solved their communication problems by installing short-wave radio nets and training interested CCC enrollees to operate them. This has resulted in the establishment of a number of schools, such as those at McCall, Idaho, Camp Ben-

ning, Georgia, and 24 other locations in between, where enrollees are being trained to take over the duties as operators of the camp radio stations.

In numerous other camps, 6,720 CCC enrollees during the last fiscal year were registered as taking radio training of one kind or another in classes organized by CCC training officials. In all, 500 camps reported that they were conducting radio training classes.

Radio training for CCC enrollees comes also from a third direction. Several of the "Using Services"—that is, the government bureaus which direct the work projects of the camps—also use radio in their work, notably the U. S. Forest Service in its all-important task of fighting forest fires. A number of short wave radios are in use by the National Park Service, the U. S. Reclamation Service, and State conservation agencies.

Two outstanding examples of cooperation by Using Services and CCC administrative officials in radio training are taking place at McCall, Idaho, and at Missoula, Montana. At Camp S-223, McCall, there has been established a school for radiomen and mechanics designed to accomplish two things: train operators to man the nine-station shortwave radio net linking isolated camps in the Boise CCC District, and to become the *alma mater* of a number of young lads qualified to serve in various military or commercial radio services.

At Missoula, the northern regional headquarters of the U. S. Forest Service, a specially picked group of CCC enrollees is being trained for the job of swiftly setting up and maintaining radio communications when one of the huge forest fires breaks loose to swamp over thousands of acres of big timber. They work under the watchful eye of Forest Service radiomen and use that Service's specially designed portable and field equipment. The Forest Service also cooperates in the training program at McCall.

The McCall CCC radio school, located amid scenic splendors on state forest land, provides facilities for a group of 30 hand-picked CCC enrollees to study a radio course which meets the rigid requirements of the *U. S. Signal Corps*. The equipment and the teaching staff would be a source of pride to any school in the country. The Idaho State Department of Vocational Education, the U. S. Forest Service, and CCC officials have cooperated to create this new kind of training center.

The school has a completely equipped shop where radio design, construction, repair and maintenance can be carried out. There is an amateur radio station in the camp, as well as the official CCC District Net station. The *U. S. Forest Service* supplies certain of its wide variety of portable equipment so that these trainees may become familiar with the operation and maintenance of what has become a powerful weapon in the control of many forest fires.

Retreat at Camp S-223, where the national defense school is maintained.

Instructor gives voice training to students to enhance operating technique.

State authorities have detailed two instructors to the school. The *Camp Educational Adviser* works like a beaver, and the superintendent of the McCall schools teaches mathematics to this group. The enrollee students are selected from the several camps within the District and are picked for their interest and aptitude in radio work. Many, of course, have had some previous amateur or other radio experience. They must serve a two-weeks probationary period, at the end of which they must pass practical tests to show how well they are responding to the start of the six-months course.

The first two months are largely taken up with the fundamentals of electricity and radio and constant practice at code. There is a special code practice table which accommodates a dozen trainees, and where "traffic" moves along under operating conditions similar to that of a radio net. The trainee must be able to handle 20 words per minute at the end of his six-months course. Many can handle 25 by that time.

The last four months of the course are given over to practical training in communications, shop repairs and servicing, and concentrated study pointing at passing the Government commercial license examinations. The school's "ham" station provides lots of practice. Of course, only those students who have procured their amateur's licenses may operate it, hence the passing of Government exams for this type of license is one of the first goals of many of the trainees.

There is also the CCC District Net station in camp. The radio trainees all have a chance to operate this station for actual traffic-handling experi-

Radio Station at Forest Service operated by CCC crew.

Learning how to read the weather is part of training.

ence. Advanced students are also sent out to various other of the nine District camp stations to man them for short periods. While in those camps on detached service, the McCall trainee in turn instructs a camp enrollee on the operation of the network station. Those in charge of the program say that this experience is beneficial equally to the enrollee-teacher and enrollee-student at the District camp.

Before he completes his training period, the advanced student is sent to the headquarters at Boise, Idaho, where for two weeks he is detailed as an operator at the 250-watt net control station there.

Enrollee graduates of the McCall School can operate the CCC network; they hold, for the most part, commercial licenses entitling them to handle almost any sort of radio operation job. They are registered with the *Idaho State Employment Service.*

Those CCC enrollees being trained at Forest Service headquarters in Missoula, Montana, will see service in one of the most noted "fire regions" in the forest lands of America. Thousands of acres of this "big timber" are deep in almost inaccessible country where it used to take days and sometimes weeks to get equipment in by pack train. Mule trains are still used, but to augment them aircraft have been put into more and more use by the foresters for the delivery of supplies, and even fire fighters, and the forest fire combat forces are now almost completely served in the field by short wave radio.

The organization of radio communications system on one of the big fires is probably akin to that of a field army. For example, on the very battle line, the fire front, are the highly portable ultra-high frequency transceivers, whereas in the various fire camps, in supply headquarters, in the main camp and back at Missoula are a number of other types ranging from portables weighing but a few pounds to portable gas engine-generator-powered equipment of much greater punch. Other channels include those over which the scouting airplanes communicate with the fire boss, those the parachuting smokechasers carry, those in the fire lookout towers, ranger stations and other points.

The creation of a trained crew held in reserve to handle the intricacies of a big radio hookup, with its many frequency channels and resultant complex operating techniques, is bound to save many a fire boss or ranger a hatful of headaches.

These handpicked CCC boys are given training not only in the use of the specially designed Forest Service radio equipment, but also in the general practices of reading weather conditions, and a knowledge of the setup used by the *Forest Service* in fighting fires. These young men will finish their tour of duty with the CCC much better prepared for serving their outfit while in the Corps, and also with valuable experience to offer a prospective employer when they leave the service of the Corps. —30—

Members of CCC radio fire crew learn how to read code and to conduct traffic.

FCC Monitoring Set-Up

Uncle Sam's watch on the ether has become as vital as sea or air patrol. Up to 900,000 words are monitored daily.

by

JAMES LAWRENCE FLY

Chairman FCC and DCB

was born at Seagoville, Dallas County, Texas, February 22, 1898. Entered the U. S. Naval Academy in 1917. Commissioned as ensign in 1920, remained in the Navy until 1923; received LL.B. degree in 1926. Admitted to the Mass. and N. Y. Bars in 1926, and practiced in N. Y. C., until 1929. From 1929 to 1934, served as a Special Assist. U. S. Attorney General. Pres. Roosevelt nominated him a member of the F.C.C. on July 27, 1939. His term of office expires June 30, 1942. He fills the unexpired term of the late A. S. Prall. His activities include many subjects.

THROUGH the *Federal Communications Commission*, the *United States Government* is now continuously listening in, recording, translating and analyzing foreign short-wave propaganda. This duty, which is essential to the national defense, is being performed by the *Foreign Broadcast Monitoring Service*, which was established last Spring by the Commission in cooperation with the *Defense Communications Board*.

All broadcasts of foreign origin are carefully watched for intelligence and trends, which are reported immediately to Government officials responsible for counter-propaganda or other necessary action. For obvious reasons, the reports and others findings of the *Foreign Broadcast Monitoring Service* are confidential. However, the general scope and work of this highly specialized unit may be explained as follows:

Four of the *Commission's* regular monitoring stations have been augmented for the particular purpose of listening in to broadcasts from various sections of the world. These stations are so located as to obtain the best reception from stations in the particular countries which they "cover."

Thus, one of these "ears" at Silver Hill, Maryland, is attuned to broadcasts from Europe, the Near and Middle East and Africa, with particular attention to transmissions beamed to North America. Another at Santurce, Puerto Rico, listens in on broadcasts directed to Latin America. A third, at Kingsville, Texas, concerns itself with broadcasts from South and Central America, while a fourth, at Portland, Oregon, takes care of transmissions from the Far East.

At these points, polylingual monitors listen to the broadcasts as they come over the air, and record them from their respective assignments, to the inclusion of newscasts, speeches, and even entertainment. From 600,000 to 900,000 words are listened to and recorded daily. The job is so arranged that significant information can be "flashed" to appropriate officials immediately, even before the recorded material has been translated or transcribed.

Today shifts in propaganda treatment are usually first evinced on the radio. For example, the altered tone of certain foreign broadcasts gave one of the first indications that Japan intended to occupy Indo-China. Consequently, through study of foreign propaganda broadcasts it is often possible to anticipate events. Speed in reporting such developments is vital to those who formulate counter-measures and other policies. Even an hour's delay may mean the difference between "tip" and fact.

Furthermore, analyses of these official international broadcasts indicate the general progapanda strategies being employed by foreign governments to influence public opinion in various parts of the world. These strategies, illustrated by official radio broadcasts, are indicative of the general lines being carried out in other propaganda media as well.

As a result, the *Foreign Broadcast Monitoring Service* functions in what might be termed a "belt line" process. In the case of field officials, significant information is "flashed" immediately to a central Washington office which, in turn, speeds it to the particular Government officials concerned.

The field stations have immediate communication with the Washington office by means of radio, telephone, teletype, and telefax. In the case of the adjacent Maryland listening post, telephonic lines "pipe" broadcasts as received directly into the Washington office, where experts listen-in and keep various Government offices currently informed by teletypewriter.

Concurrently, broadcasts are recorded in the field offices and in Washington. As each transcription is completed, if it is in a foreign language, it is turned over to translators. About 75 per cent of all programs intercepted from abroad are in languages other than English. These translators make a quick rough draft, which is typed on master ditto sheets. If the broadcast is in English, the record is transcribed immediately. The three field offices far removed from Washington also do their own translating and transcribing, and their master ditto sheets are rushed to the capital by air mail.

Each listening post is a unit in itself, with engineers, translators, transcribers, stenographers, and report compilers. However, all analysis work is done at the control office in Washington.

Continuous duty—24 hours a day, 7 days a week—is necessitated by time differences throughout the world.

Copies of all transcripts go to an analysis section in Washington which is charged with the work of long-range study. This section's work is performed on a proportionately current basis, so that each day there are trend observations on the previous night's broadcasts. In addition to spot bulletins, daily analytic reports, and complete digests of broadcast material, the *Foreign Broadcast Monitoring Service* furnishes weekly summaries and special reports. Naturally, all these reports are confidential and are not of public issue.

Uncle Sam's watch on the ether has become as vital as sea or air patrol. Broadcasting is a new but powerful factor in international relations. In the World War there was only limited wireless telegraphy to contend with. Today the world is radio conscious, and broadcasting has recognized value in influencing peoples as well as providing instantaneous communication. In consequence, the present volume of international broadcasts is tremendous. The German radio bombards the United States with nearly 11 hours of emissions daily, the British send us about 6½ hours, Japan 4½ hours, and Italy more than 4 hours, and a score of other nations in lesser proportions.

With censorship overseas becoming sterner and ordinary news sources abroad drying up to an alarming degree, it is pertinent that the *Foreign Broadcast Monitoring Service* probe the great volume of foreign radio pronouncements for clues to transpiring events, and to do it promptly and efficiently, and to rush its findings to Government military and other officials who are particularly concerned with measures to safeguard this nation.

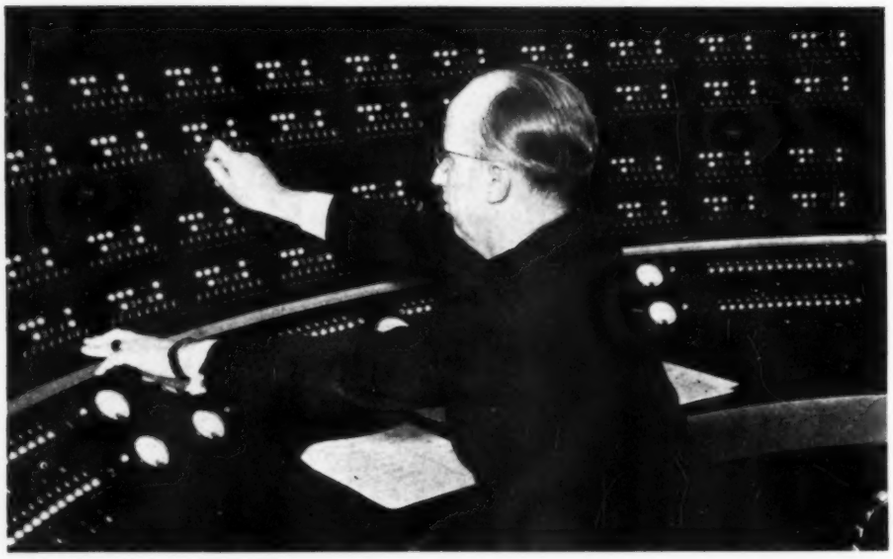
-30-

NBC DEFENSE NET

Adequate protection is guaranteed for program transmissions by independently-powered broadcast stations

by NILES TRAMMELL
President NBC

Born in Marietta, Georgia, July 6, 1894. He attended school at Sewanee Military Academy and the University of the South. When the U. S. entered the World War he was commissioned 2nd Lt. in the regular army at Ft. Leavenworth, Kans. He saw military service at Ft. Snelling, Minn., Camp Devens, Mass., and at Fort Benning. After the war he was 1st Lt. in the 36th Inf., 12th Div. Joined the National Broadcasting Company as salesman in March 1928. On July 12, 1940, he became NBC president.



Master Control Board, center of NBC's vast network, located at Radio City.

Power Control Desk showing miniature supervisory equipment on panels.

THE war in Europe, now in its third year, has given thoughtful Americans, mindful of the defense of the nation, many lessons. But of all these, two stand out high above the rest. The first is a lesson in national unity. The other is in the defense use of the gifts of science.

We have seen a nation whose men and women were so deeply engaged in factional quarrel that they forgot to protect the rich heritage that was theirs until at last, poisoned with intrigue and torn by dissension, they were crushed under merciless, swiftly moving engines of war.

We have seen also the movements of divisions armed to the teeth with almost fantastic adaptations of scientific discoveries. Dive bombers, mechanized and motorized land units, military parachutes—these are only a few of this war's new weapons. Radio is certainly one of these. It has been used on the battlefield to coördinate movement of airplane and tank and motorized unit.

Radio broadcasting, too, has been pressed into service. It may be an aggressive force. We know "Lord Haw Haw" and "O.K." well, even on this side of the Atlantic. I am more concerned here with radio's use as a strictly defensive weapon, for broadcasting has a vital sector to hold on this front.

International conflict, in our world, is "total." The decisive factor, apparently, is industrial productivity. The fate of a nation hangs on its assembly lines and the men and women who tenaciously stick to their posts to produce an ever-mounting product of arms and clothing, food and fuel. Incendiaries and demolition bombs rain down from the skies to paralyze industry, to shatter the morale of the civilian population. It is here that broadcasting becomes a force of incalculable power, both as a practical instrument of defense and as a stimulant to that living patriotism without which a nation's arms are sapped of their strength.

The radio industry, coöperating with government agencies, has given much thought to the uses of radio broadcasting in national defense. We have laid plans for fitting it into practical schemes for protecting our great cities and our industrial lifelines. Nationwide plans have been completed for the emergency use of standard broadcasting stations in air-raid warnings and other messages, communiques and various types of announcements.

We must assume that civilian defense will have national, regional and local aspects. Civilian defense in its national aspect, must confine itself to broad educational efforts and instruction in practices of universal application, together with what messages the national leadership has to communicate to the people. For that purpose we already have admirable facilities in several networks that stretch from coast to coast and from Canadian border to the Rio Grande frontier with Mexico. These could be joined together in what the *Defense Communications Board* has called a "super-network."

A radio-in-defense survey recently completed showed that of the approximately 880 operating broadcasting stations in the standard broadcast band, nearly 500 were already connected, by wire circuits, to the proposed super-network for national defense. Another 132 stations with studios in cities now served by components of the proposed super-network, require only local circuits to effect their union with the network. Finally, 240 were situated along the network lines so that short wire circuits would tap them into the network. Ordinary telephone lines could be pressed into service to bring 12 remaining stations into the defense structure.

Civilian defense will also have regional aspects. Different geographical areas will face different defense problems. New England, for instance, with its thickly populated industrial centers, will have quite different plans laid for the defense of its textile and machine tool plants from those applicable to the oil fields of east Texas, Louisiana or Oklahoma.

Here it becomes possible to use radio broadcasting to coördinate the activities of all associated defense units of a particular region. Approaching bomber fleets, for instance, would send not one, but many, local units to their posts, since an attack might include more than one industrial center. Radio broadcasting might be used as the "alert."

Locally, radio broadcasting is of paramount importance, for it is the voice which speaks once and is heard simultaneously by all. It may sound the alarm that sends every man to his defense job, ready for action. It may be the control that moves civilian forces from one quarter to another where the need is greater.

Technical adjustments necessary for successful use of radio broadcasting in civilian defense would be quite extensive, particularly in fitting the broadcasting pattern to national and regional defense schemes. We have indicated that the present national networks, augmented by the addition of more stations, would form a super-network for defense purposes. It would probably be found, also, that special technical facilities would have to be added to connect regional and local broadcasting networks and stations for defense purposes to strategic control points. New circuits could accomplish this end.

Police Capt. J. J. Martin releases inaudible pulse to control alert receiver.

Broadcasting in the national defense, it has been pointed out, will be only as successful as it is free from either accidental or deliberate interruptions. In the case of most broadcasting stations, now these interruptions are so rare as to be practically negligible. Since the most frequent source of such breaks is power failure, adequate protection for power supplies must, in many instances, be incorporated into present transmitting plants. One-tenth of the nation's stations are now equipped with independent generating plants, enabling them to continue broadcasting up to the moment that such a station is destroyed. Other stations have more than one source of public power; but in perhaps the majority of cases broadcasting stations must take new precautions against being forced off the air by power failures.

For the nation-wide super-network, the existing 45,000 miles of program transmission circuits make alternative routes available to 308 of the 310 cities now being served. From this it is apparent that a break in any particular transmission circuit, during a nation-wide broadcast over the super-network, could be compensated for by simply re-routing over another transmission line.

Adequate protection is guaranteed for these program transmissions by battery reserves in 4,000 relay centers, by multiple independent public power supplies in 800 relay centers. Emergency power is available at 50 centers from completely independent generating plants and more than 200 power plants are available throughout the country.

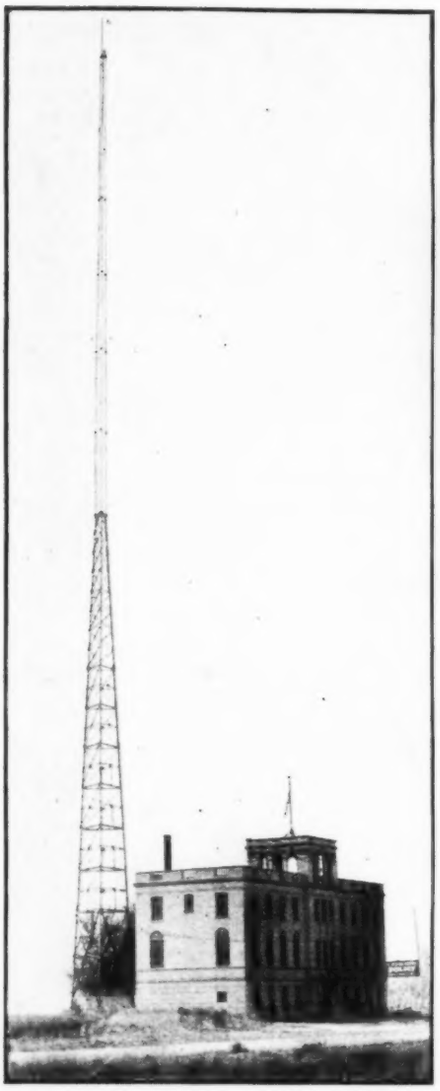
There are many other aspects of the problem of assuring continuous operations of the nation's broadcasting plant in times of emergency which I shall not go into here. But before I leave the strictly practical applications of broadcasting in national defense let me illustrate radio's work with two instances.

The *National Broadcasting Company* recently suspended network service for fifteen minutes to test a plan for nationwide transmission of confidential information during an emergency period. More than 200 NBC commentators and newsmen from Atlantic to Pacific tuned in at a predetermined minute to hear Major General Robert O. Richardson, Jr., and Rear Admiral Arthur J. Hepburn explain, from Washington, the public relations policies and methods of the *War* and *Navy departments*.

The public meanwhile listened to local musical and news programs, completely unaware that the national network had been diverted to confidential use.

On another occasion Mayor Fiorello

(*Continued on page* 107)



Steel radio tower for County Police.

Radio operator at the control desk of a modern police radio transmitter.

POLICE Radio Nets

The radio-equipped police nets work with Federal Agencies

by L. S. FLETCHER

Comm. Eng. Ill. Cook Cy. Police

Received his education at Cornell Univ. and RCA Institutes. Began his radio career at station WIBO in Chicago in 1930. In 1933 acted as consulting engineer for the village of Winnetka, Ill. He joined WLW in Cincinnati until 1937. In 1939 he was made chief communications engineer for the Cook County Illlinois Police Dept., and designed and installed the Cook County system of 3 fixed stations and 94 mobile units.

Tuning the Police transmitter unit.

WITH a vast network of 1,808 radio stations scattered throughout the country, police radio is destined to become one of the most important units in our national defense program.

The various police radio systems are composed of 1196 municipal police stations, 513 state police, 69 zone police, 30 interzone police, several thousand mobile two-way units, and a few teletype networks.

We venture to say there is no communications system in the country, other than the telephone or amateur radio, perhaps, that can reach into every little township and county in practically every state in the country with the exception of a few of our western states, in the manner achieved by our police radio systems.

Just what part such a communication network is playing in our national defense program is now known. The combining of our entire nations resources and manpower toward one unified program would indeed be a very difficult task without the aid of instant communication. Our public wire services have served well, and will continue to serve even as the emergency situation increases in intensity. However, since any wire system is subject to impairment, it must be backed up with a system that is independent of wire and cable lines. Radio communication and its allied branches, of course, is the only system that overcomes these difficulties at the present time.

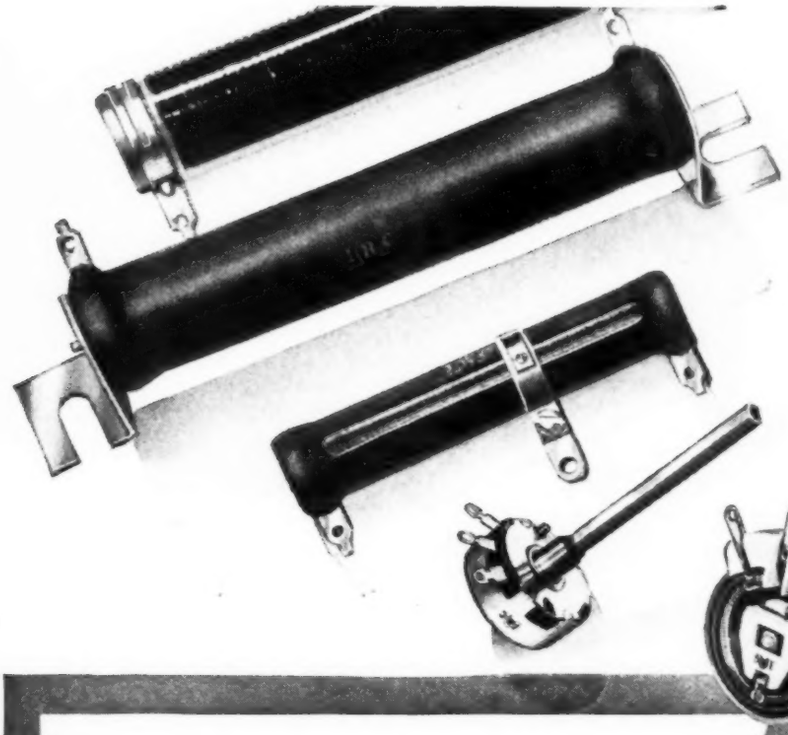
Since rapid communication is such a vital necessity in this vast unification program, we will endeavor to explain what police radio is doing at present in this work and what it would be capable of doing in the event a war should occur.

Practically every township of a few thousand population up to the large cities either have a police radio system of their own, or are tied into a larger neighboring municipal or state police station on a coöperative basis.

Under this coöperative plan, many of the smaller towns are capable of having a radio contact with very little expense. As they need only furnish their police car or cars with a receiver, or a receiver and transmitter capable of operation on the frequencies used by the neighboring station.

The larger towns and cities usually have their own police radio stations, each with its own method of operation and procedure. As the size of the municipality is increased, more power is granted to the station or stations used. The FCC rates the amount of power to a municipal station on a basis of population, with a maximum power of 500 watts for any given station. All townships, cities and counties are classified as municipal stations.

(*Continued on page* 108)



RESISTORS FOR DEFENSE

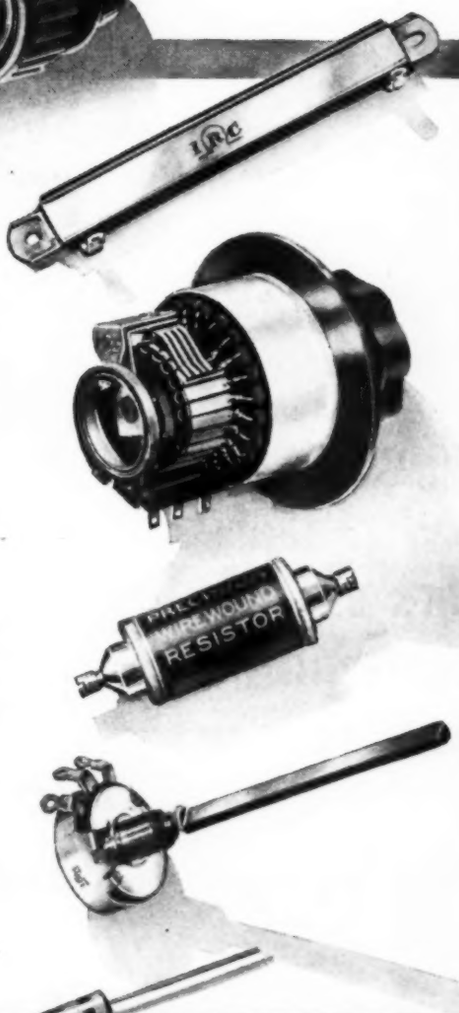
Resistors to satisfactorily meet the government's exacting and unusual requirements are an old story to IRC.

Many years of close collaboration with government agencies in the preparation of resistance specifications and in the development of special resistor types have been a natural result of IRC's acknowledged leadership in a highly-specialized technical field.

Today, with the tempo greatly accelerated in the face of national emergency, this background of specialized experience is proving of immeasurable benefit to defense manufacturers and their subcontractors.

It means informed engineering cooperation. It means the availability of tested and proven resistors of the many types required for the comprehensive defense program. It means elimination of guesswork and experimentation in obtaining with all possible speed the *right* resistor for any particular application.

Bring your fixed and variable resistance problems to IRC. Our engineers will be glad to cooperate.



INTERNATIONAL RESISTANCE COMPANY

401 North Broad Street, Philadelphia, Penna.

IRC

Makers of Resistance Units of More Types, in More Shapes, for More Applications Than Any Other Manufacturer in the World.

Training—Signal Corps
(*Continued from page* 23)

factory in handling large groups of students. It allows a continual flow of students through the school and provides a means of obtaining the maximum employment of equipment and instructors throughout the course.

Under this method of instruction every student is given a set of mimeographed information sheets which he may study either in the classroom or at his leisure in the barracks. Each lesson is supplemented by a quiz and in most cases by a laboratory exercise. If a student experiences any difficulty with either the subject matter, or the laboratory assignments, he is free to call upon any one of the instructors for help.

The student must maintain a steady pace if he wishes to complete his training within the allotted time. A check is kept on his progress by means of "Progress Tests" which are periodic examinations in the subject matter covered. For example, in the radio theory course there are five of the latter, in addition to the final examination. Certificates are granted to those men who complete all of the subcourses required for qualification in the specialty in which they are enrolled. These certificates are invaluable to the men who want to get ahead in the service and constitute an incentive for each student to put forth his best efforts.

The *Aircraft Warning Department* of the school conducts a three-month specialist course in the maintenance of Aircraft Warning Equipment. The student body of the *Aircraft Warning Department* is composed of officers and enlisted men who are sent to the school from various Aircraft Warning Companies, Signal Repair Companies, Signal Depot Companies, and especially qualified graduates of the Radio Repairman's Course in the Enlisted Men's Department. Similar courses are given to both officers and enlisted men.

Subcourses given in the *Enlisted Men's Department,* Radio Repairman's Course, are prerequisite for entrance to the *Aircraft Warning Department.* In general, all instruction is practical; only so much theory is taught as is considered essential for the performance of maintenance operations. Expansion of this department is presently expected and will continue until a capacity of 80 officers and 320 enlisted students is attained. At the completion of the course students are returned to the organizations from which they came or to new units in the process of being organized.

The *Department of Training Literature,* with a director and a staff of commissioned officers, prepares the extension course of the school, *Signal Corps* and signal communication field manuals, technical manuals for operation and maintenance of items of *Signal Corps* equipment and examinations for promotion of non-commissioned officers to the first three grades. Drafts of field manuals, technical manuals and extension courses are submitted through the Chief Signal Officer to the Adjutant General for publication in the *Government Printing Office.* This material is then used throughout the Army. In addition this department prepares material for and supervises non-photographic phases of production of training films on *Signal Corps* and Signal communication for all arms subjects.

Together the *Signal Corps School* and the *Signal Corps Replacement Training Center* are the channel through which a civilian moves to find his proper place in this arm of the service. It is possible for a civilian to come first to the *Replacement Center* then receive basic training, go on to the *Enlisted Men's Department* of the *Signal Corps School* and from there to the *Officer Candidate Department.* Graduating from this department, he could, as an officer, go to the *Officers' Department* of the School, all without leaving Fort Monmouth. This central close-knit organization makes possible a highly integrated, closely controlled educational system for the *Signal Corps.* —30—

Coast Guard

(*Continued from page* 48)

2,000 to 13,000 kc., CW or voice, with 100 watts power.

A complete operating position is built in with two typewriters, four receivers and two identical transmitters. There are two reel antennas installed for intermediate frequency operation and two 25 foot telescopic vertical radiators for high frequency operation. Sleeping quarters are provided and all necessary equipment to sustain the crew (3 men) and give assistance to others under all conditions. The communication truck is always accompanied by its auxiliary truck, a lighter 1½ ton vehicle carrying a portable transreceiver of 5 watts power and 2 men. This truck is to perform scouting duty for the main truck and report back to the commanding officer by radio and to keep the mobile station supplied with the necessities of life.

It can now be seen that radio, in all its phases, is a vital necessity to the *Coast Guard*. Without it the hundreds of small boats in the bays and harbors, the dauntless cutters on the far flung highways of the sea, the searching airplane soaring over the wastes of water or devastated country, the lifeboat stations and light stations strung tenuously along the thousands of miles of deserted beach, the truck struggling through flood or hurricane and the lonely lightship could never be coordinated into effective tools to carry out the humane and varied duties to which the *United States Coast Guard* is dedicated. Radio has given to the *Coast Guard* motto "Semper Paratus" a new and living meaning.

The *Coast Guard* is contributing substantially to the development of the many branches of the communication field. The very nature of *Coast Guard* duties continually requires better, faster and more completely integrated communications, both within the service and with commercial and private stations in need of assistance or cooperating in rendering assistance.

The *Coast Guard* is a military service, part of the armed forces of the United States. One of its duties as set forth at the beginning of this article (paragraph 2, subparagraph 12) is that the *Coast Guard* shall operate as a part of the Navy in time of war or when the President shall so direct. The place of the *Coast Guard* in defense and offense is delimited by that law. The training and organization of the service is such that the Navy can, with a minimum of disorganization, fit the *Coast Guard* communication system into their plans for offense or defense either as a unit or in part. The men and material of the *Coast Guard* are ready.

-30-

80 Million Metal Radio Tubes

Placed 18 inches apart, the 80 million metal radio tubes sold since 1935 would reach around the world! More important, these 80 million tubes attest the tremendous acceptance accorded by the industry to the finer performance of metal-envelope tubes!

. . . and RCA is now producing metal tubes at fastest pace in history!

CURRENT PRODUCTION of metal tubes is the greatest in history — for the amazing *acceptance* accorded to metal tubes is still *increasing!* 80,000,000 metal-envelope tubes have been sold since 1935 . . and today *four* of the *six* largest-selling tube types are *metal* types!

Will They Be Available—?

If you have found difficulty or delay in obtaining RCA Metal Tubes, remember the reason: *it is not because production is low but because both defense and commercial demands are high.* And defense comes *first!*

Naturally, priority requirements in materials may limit the general availability of *all* types of tubes—for all types require valuable and limited metallic materials in their *internal* structure.

12 REASONS WHY
METAL Tubes are BETTER Tubes!

- Complete Self-Shielding
- Greater Flexibility in Design
- Greater Precision and Uniformity
- Lower Interelectrode Capacitances
- No Envelope Emission Troubles
- Freedom of Placement on Chassis
- Higher Getter Efficiency
- Simple, Efficient Grounding
- Single-ended Construction
- Large Pin-Contact Area
- Lower Socket Costs
- More Rugged Construction

METAL TUBES

RCA Manufacturing Company, Inc., Camden, New Jersey

A Service of the Radio Corporation of America • In Canada: RCA Victor Company, Ltd., Montreal

The Navy

(*Continued from page* 52)

equipment can be retained at least temporarily though nearly all such equipment must be augmented to meet fleet communication requirements. Combatant vessels come first by necessity in all methods of planning, but we are able to say at the present time that communication service between the *Navy's* vast network of shore establishments, territorial possessions and outlying bases is the highest grade, with tremendous speed of operation from ship to shore. As an example naval air stations have more than doubled in numbers and the same can be said of bases, inshore patrol facilities, harbor control stations and those established to carry on special activities.

Communication personnel has doubled along with the increase in ships, men, planes and bases, and their training is being carried out in schools with total annual capacities in excess of 11,000 radio men and 2,000 signal men. Schools for operators are maintained in Norfolk, Great Lakes, San Diego and at the Navy Yard in Cavite, Philippine Islands. Aviation operators receive their initial naval training at Jacksonville, San Diego, Alameda and Seattle. Likewise material personnel are being trained at Key West, New London, Washington, D. C. and other points. Signal schools are maintained like radio schools and coordinate their activities and knowledge.

Probably the greatest development has come in training naval reserve personnel. Six separate training centers can handle a total number of about 5,000 annually, while two signal schools can take care of over 1,200 reserve applicants.

I cannot stress too highly the work we are doing with the Army in our common efforts toward perfecting the National Communications Defense. Joint radio procedure between Army and Navy is used not only for intercommunication in peaceful pursuits, but is coordinated for any action that might occur involving both ground and sea forces. The *Defense Communications Board* created by the President in September, 1940, has done much to coordinate not only *Army* and *Navy* efforts, but has brought about a finer understanding between military, naval and commercial services. A most notable accomplishment of the *Board* has been its plan for alternate routing of traffic to meet essential commercial requirements should normal routing cease to function. The studies of the *Defense Communications Board* extend to the questions of priorities and their assignment and physical protection of plants.

There is a great deal I would like to say regarding the progress of sound and underwater communication but

(*Continued on page* 82)

Be It LARGE Or SMALL

▲ Weight 315 pounds—this Electronic Battery Charger is used in Railway Cars. (220 A.C., 3 phase, 60 cycle.)

▼ Weight 7 ounces . . . this Electronic Auxiliary Box operates aircraft 4 w. Fluorescent Lamp. (110 A.C., 400 cycle.)

ELECTRONIC Designs and Builds Power Supplies to Meet Your Needs!

● For charging batteries or operating lights . . . or whatever it may be that requires a power supply—Electronic engineers can design a power supply to meet every condition perfectly! They are expert in providing the desired power output within whatever space or weight limitations are necessary . . . and Electronic can *manufacture* any power supply unit that is needed in small as well as large quantities.

Already, Electronic has solved the power supply problems—and is supplying the needed units—for many kinds of equipment essential to the U. S. Army, Navy and Coast Guard. Electronic's Ultra-Violet Black Light Equipment is required on U. S. Army and Navy planes for instrument illumination. And Electronic units are essential in such various applications as the Sperry Directional Compass—in powering aircraft instruments—in radio controlled equipment—in fluorescent lighting systems—and in signalling equipment . . . to name a few!

Electronic engineers are ready to tackle any other power supply problems of defense equipment . . . and civilian equipment, too!

ELECTRONIC LABORATORIES, INC.
INDIANAPOLIS, INDIANA

Navy

(*Continued from page* 80)

the *Navy* rightly protects those methods and designs that it regards as being of potential help to an enemy. I would like to mention the splendid cooperation we have received from amateur radio operators in our weekly broadcasts and to these thousands of young people the *Navy* is indebted for many of the fine radio enthusiasts who are achieving success now as members of our communication service.

The *Navy* has never been found wanting at sea and its tradition of victory will be kept in the present world chaos. Thanks to the many thousands of men and women in radio, to the short wave listeners and operators, to the producers of our equipment which is the best in the world, *Naval Communications* I am sure will always be ready for its full and efficient part in maintaining our democratic institutions. —30—

Amateur Radio in Civilian Defense

(*Continued from page* 67)

many states this work is well under way and in others it is now being planned.

(2) Local communication on ultra-high frequencies within municipalities, on behalf of the OCD. Here is where the great body of amateurs will be able to render invaluable service to their communities. The exact design of this phase of the OCD work is now being worked out and it is expected that manuals will eventually appear giving instructions on the utilization of amateur radio in the ARP system. When these plans take form it is probable that they will provide that amateurs should enroll at their local civilian-defense volunteer centers in the same fashion as ARP wardens, volunteer nurses and doctors and other specialists. They will then be assigned to a special radio unit under the command of a communications leader who supervises all emergency communications, selected on the basis of broad administrative experience. Until this machinery is set up, ARRL is asking all interested hams to register their readiness with the *League's Local Emergency Coördinators,* and the latter are supplying liaison between the amateur body and the local defense councils.

Along the coasts, where the probability of a need for active ARP work seems greatest, the organization will be more comprehensive and detailed than inland. The experience abroad indicates that the degree of need for the amateur auxiliary links will probably be in direct proportion to the seriousness of the situation.

In most cases the amateurs will supply their own equipment; a few centers may be equipped by the local authorities but this will be the exception rather than the rule. Every city will need a master-control station located at the municipal communications center, maintaining constant contact with outlying towns and with a master network tying the control center to police and fire headquarters, the Red Cross, mayor's office, hospitals, etc.

In the larger cities there will probably be specialized interior networks within the police and fire departments, supplementing the normal communication systems of these departments. Portable pack units and motorized mobile units will be required for patrol, to accompany rescue squads, assist special police in the guarding of key points, accompany fire marshals to large fires, etc. The utilities will require special nets to keep them in touch with dams, reservoirs, cable crossings, auxiliary stations and other vital points.

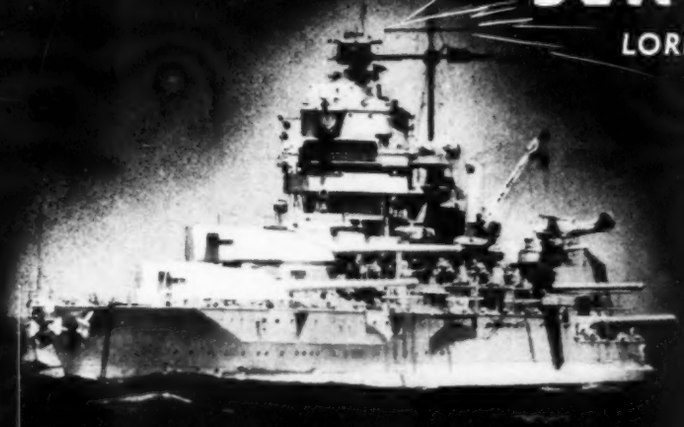
In line with these needs, the ARRL has for many months past urged radio amateurs to equip themselves with self-powered movable 2½-meter gear (not transceivers!)—preferably powered from a storage-battery rather than a dry-battery source, because of the preferential requirement of the military for replacement dry-cell batteries. Thousands of amateurs already have equipment capable of operation independent of the power mains—not all of it 2½-meter gear but much of it readily convertible—and thousands of new rigs are expected to be built in coming weeks.

This indicates the already-high state of amateur preparedness. I have said before that *the amateur is accustomed to dealing with emergencies;* the paramount lessons he has learned through his experience are that one never knows how or when they will strike, and that preparedness is the vital essential. When the OCD began its planning for emergency communications, in late October, it found a groundwork of planning and equipment already laid. We were getting ready, ahead of the need. It is our firm purpose to be equally ready for whatever the future may bring.

—30—

"...FOR THE LOVE OF GOD...LET US HAVE ...SOME GREAT SHOT SENT US..."

LORD HOWARD—BATTLE OF SPANISH ARMADA



TODAY three quarters of the world is crying, "For the love of God let us have, and with great haste, more tanks, guns, planes, ammunition, trucks, etc." There can be no doubt in the hearts and minds of all Americans that these demands must and shall be met with all possible haste.

Of equal importance is the reliability of this armament and the permanency of its associated equipment. Greater than we realize is the part radio communication is playing—vital in its necessity, absolute in its dependability. The foundation of all radio equipment is transformers.

We at Kenyon take justifiable pride in knowing that whatever small part has been ours to contribute, then that part carries the character of our company. It is significant that wherever you see the Kenyon "mark of excellence", you will know that the men around it have seen fit to place their lives and their destiny on, "There can be no failure".

To these three-quarters of the world, we are at your service and, "For the love of God we *will* give you *more* shot and with *greater* speed".

THE MARK OF EXCELLENCE

KENYON TRANSFORMER CO., INC.

840 BARRY ST., NEW YORK, U. S. A.

Marine Corps
(*Continued from page* 56)

degrees in electrical or communication engineering from civilian colleges or universities.

"Communication Personnel" in the *Marine Corps* has come to mean a high type of intelligence. It is only fitting that the best possible equipment should be supplied these men for the efficient performance of their duties. And it can be said without fear of contradiction that *Marine Corps* radio equipment is the best in the world. It is with regret that complete descriptions and circuit diagrams cannot be included in this article. The portable equipment is entirely conventional and only circuits and components which are "tops" are utilized. If you can imagine a small portable receiver and transmitter all wrapped up in one metal box, with the receiver having sensitivity as good or better than a high priced "ham" receiver, with the transmitter having a highly stabilized electron-coupled oscillator and band-switching — and small enough to carry on your back —well, that's about as far as the description can go. And these little radio sets can "take it" and still keep on putting out.

Among the ranks of *Marine* operators are many amateurs. So that they may keep their "hand in" the *Marine Corps* has seen fit to provide two stations, one at Quantico, Virginia (W3ELN) and one at San Diego, California (W6FWJ). These stations have maintained many schedules for the mutual benefit of all Marine Corps personnel.

Nowhere in any other service, can the radioman find such a variety of work, from keying transmitters putting out weak little whistles to those with hundreds of kilowatts in the antenna. So the Marine must be just a little better, and we are doing our best to keep him that way—for who knows, it may not be long before "The Marines have landed and have the situation well in hand."

—30—

NOTICE! Regular features will be back in the next issue of RADIO NEWS

NYA

(*Continued from page* 64)

each composed of six highly portable radio units for use by scouting parties around large fires, so that crews may keep in touch with each other on developments on all fronts of the blaze. It does not require a great deal of imagination to see the value of such equipment in combating fires and devastation due to air raids in the large cities of America.

In the same line NYA radio engineers have recently developed a model radio transceiver for the use of roof-watchers in air raids, designed to make it possible for such watchers to report to a central fire-fighting unit headquarters. NYA radio shops are ready to begin production of these sets on a large scale when the needs of civilian defense requires it.

A typical NYA radio shop is that located at the Quoddy NYA *Regional Resident Center* on Passamaquoddy Bay in Maine. More than 60 youth pass through the shop each year to jobs in private industry. While at the project, they gain practical experience in all phases of radio construction and repair, as well as off-the-job.

Citizens of Maine have no hesitancy in praising the good work of the Quoddy radio unit. Its value was demonstrated most strongly in April, 1940, when a 68-mile easterly gale and blizzard destroyed the electric and telephone facilities in the northern part of the state. Wharves and shipping in the area suffered considerable damage. During this period Quoddy radio station W1MII was the only link to the outside world. Messages were relayed to the amateurs down the coast, and to the *Coast Guard Station*. Messages were also relayed for the *Eastport Weather Bureau*, valuable information for sailors at sea.

The same youth who stepped into the breach in this emergency situation have made a great contribution to the advancement of law and order in the state through the construction of a police radio system. The state put up $10,000 for materials and equipment and NYA furnished the labor.

Under the cooperative arrangement

NYA youth did all the assembly, construction and installation work. The first unit in the system provided for two fixed transmitters, WSTR at Thomaston and WSWD at Wells, and 15 mobile units operating with 10 watts power on 39,800 kcs., installed in police scout cars. This made possible car-to-car communication within an 80-mile radius when operating through one of the fixed transmitters, or within a radius of 20 miles with direct car-to-car communication. The antenna system for the fixed transmitters includes a 205-foot tower, founded on a steel plate which is kept in place by bolts protruding from a cement foundation. Several driven copperweld groundwires around the foundation are used to ground the steel plate. The mast is a 101 wind charger type and was delivered to the NYA in about 6,000 pieces. A crew of seven NYA youth, although without previous experience in this type of job, assembled the mast without error at the rate of one running foot every half minute.

Another outstanding NYA radio project is a resident center located at Tonkawa, Oklahoma, and devoted exclusively to radio. Here 150 youth are working producing radios, inter-office communications systems, and transmitters. Numerous co-sponsors over the state, such as police departments and public schools, are receiving the benefit of their work.

Related training in code work and academic radio theory is given by instructors paid by the *State Board of Vocational Education*. The combination of theory and practical experience fits youth for jobs in industry. Such experience, particularly with the code, will be of great value to those young men who are called to *Army* service since they will likely receive ratings early in their military career and be assigned to radio work for the *Army*. The result will be of benefit to the youth who will obtain further experience in their chosen fields and to the defense forces who will obtain pre-trained personnel.

AARS

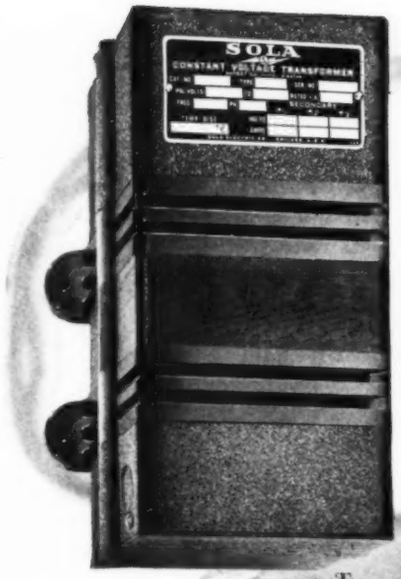
(*Continued from page 42*)

teurs are assigned to radiophone nets usually in the 160 meter and 75 meter amateur phone bands. All members, however, must be proficient radio telegraphers, able to send or copy the International Morse Code better than 15 words per minute. Members are given instructions in the use of Army radio procedure for both radiotelegraph and radiotelephone operations. Initial training and practice in Army routines also are provided for this growing group of radio amateurs and, in addition, they are becoming increasingly proficient in the operation, maintenance and installation of high frequency radio equipment.

The relaying of messages between amateur stations and for the general public has been an important function of the *Army Amateur Radio System* since its organization. The training derived from handling these personal messages has been of great value in improving the operating proficiency of members, particularly their code speed. The big expansion of the Army during the past year has caused a large increase in these amateur radiograms, especially to and from the men training at the various Army posts and stations. Army Amateur stations are handling the bulk of this traffic for the men in the service. In some camps, Army Amateur radio stations have been established, by amateurs who have been inducted into the service or by the *National Guard* units, to handle these messages. In general, amateurs are relaying and delivering this service personnel traffic at their own expense as a public service.

A number of contests and tests are held frequently to test the efficiency of the AARS nets and the proficiency of the members. The Annual Armistice Day Message Contest was held on Monday, November 10, 1941. Each member was required to copy a message, originated by the Chief Signal Officer and transmitted by the Army Amateur NCS, WLM/W3USA, Washington, D. C., and mail a copy to his corps area signal officer for checking. A "ZCB Intercommunication" Contest usually is held in the Fall and Spring. Members try for a large score. A code speed contest is scheduled for January 5, 1942. It is planned to make Automatic Tape transmissions at speeds from 20 to 60 words per minute, in increments of 5 w.p.m., from WLM, the Army Net Control Station in Washington, D. C., on both the 3497.5 and 6990 kc. special frequencies starting at ten p.m., E.S.T. All radio amateurs can participate and submit their copies to their respective corps area signal officers for scoring. —30—

The Army has issued an urgent call for radio operators for the Signal Corps. Young men between the ages of 18 and 25, unmarried and without dependents, in good physical condition are urged to apply at once at their nearest recruiting station. Men with slight physical defects which do not interfere with the normal performance of their duties are acceptable and will be used to replace other trained operators for more urgent duties. The Naval Recruiting Office is also in urgent need of men technically trained to learn the operation of new secret radio equipment. Age limits are 17 to 35. Further details may be obtained by inquiring at your local Naval or Army Recruiting Office.—Editor.



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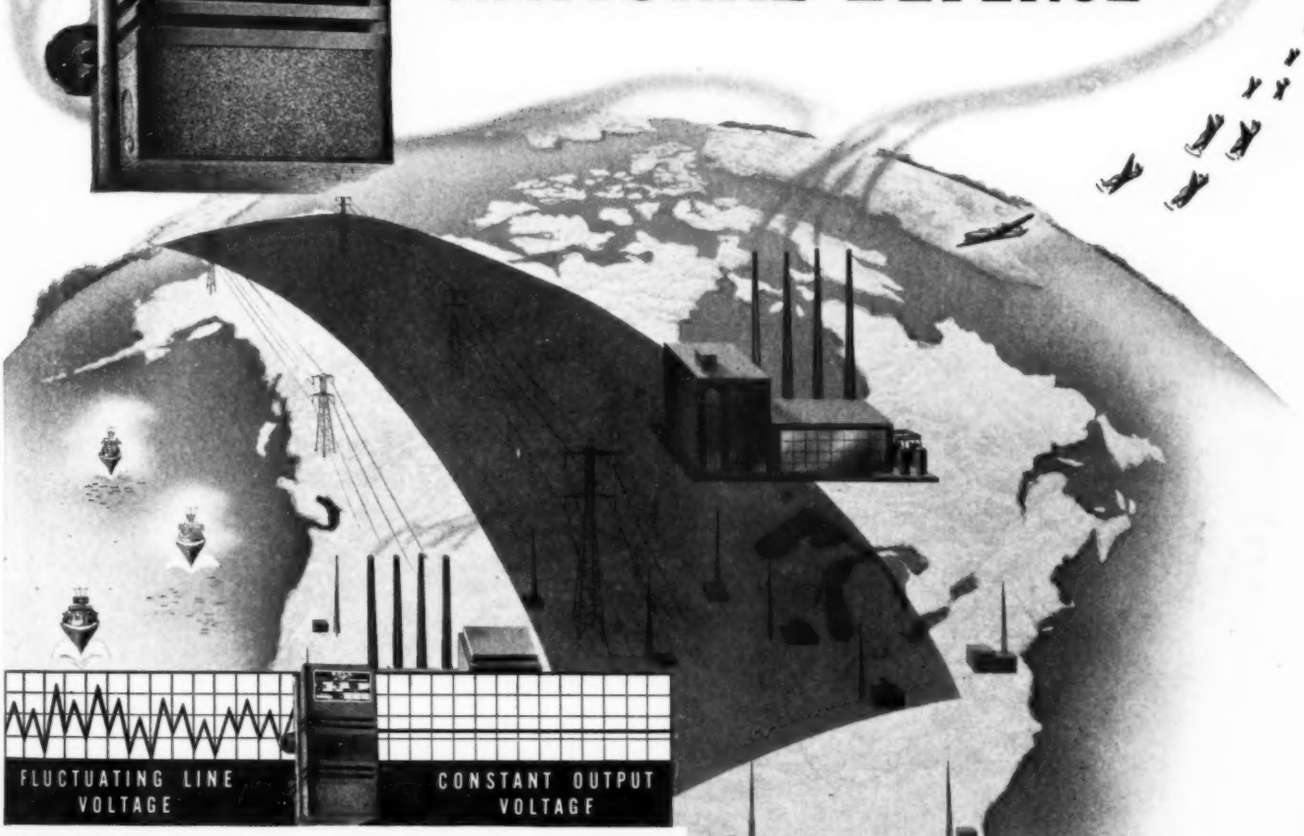

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War Dept. Radio Nets

(Continued from page 40)

In 1931, high speed siphon recording equipment of the latest commercial design was installed in the *War Department Message Center* to expedite the handling of the increasing traffic. The manual operated transmitting keys were replaced by the Boehm transmitting heads employing paper tape perforated in the International Morse Code. The signals are now read visually from the siphon recorded tape by the radio operators who can transcribe these visual tape signals at 60 words per minute as compared to the usual 25-35 w.p.m. speed by the manual aural method.

In connection with the installation of the high speed equipment, a remote receiving station also was constructed in the year 1931 on a six acre site known as Battery Cove on the outskirts of Alexandria, Va. The received radio signals are sent over leased telephone lines to the recording equipment in the *War Department Message Center.* This location, about 10 miles from Washington, affords high signal to noise ratio conditions so essential for the efficient operation of high speed recording apparatus. This area along the banks of the Potomac River also provides space for the many directional rhombic antennas which are necessary for maximum receiving efficiency. At present, the remote receiving station contains over 15 complete diversity receiving sets and 40 odd high frequency receivers to cover the many frequency channels used by station WAR. Some of these receivers are utilized by *Army Amateur* net control station WLM-W3USA whose control positions also are located in the *War Department Message Center.* A crew of trained men under Master Sergeant Thomas A. Hendricks "ride the gain" in this remote receiving station.

A battery of modern high-frequency radio transmitters is utilized in the WAR Transmitting Station, Fort Myer, Va., to maintain communications with the far-flung outposts of the *Army.* These sets range in power from 300 watts to 10,000 watts for working the west coast and Hawaii 24 hours daily throughout the year. Each high power transmitter normally has its own rhombic antenna directed towards the distant receiving point.

The *Signal Corps* is proud of the part it is playing in providing the most modern communication means for the *Army* during the present emergency. New equipment and methods are constantly being developed by the *Signal Corps Laboratories* at Fort Monmouth, New Jersey, in cooperation with the commercial communication organizations, to afford improved facilities and operating techniques for the *Army.*

-30-

Infantry

(*Continued from page* 33)

in communications since the Peloponnesian War, but it is true, except, of course, in highly stabilized or purely defensive warfare. This lack of progress was not confined to our army alone. It was true in all armies. The reason, of course, lies in the continual movement of all elements in the foremost combat zone. Other arms may be at rest occasionally on the battlefield but the *Infantry* never. Even when temporarily at a stand still, conditions do not permit the installation of equipment nor even its transportation unless of the smallest and lightest kind. You can hardly expect to maintain communication by wire while continually moving, especially under small arms fire from the enemy.

It can actually be argued that infantry communications in the forward combat zone had deteriorated since the world War, because visual means, such as flags and signal lamps had fallen into desuetude, and had disappeared from infantry training schedules and literature. This happened, no doubt, because of the limited use made of these means under the highly special conditions under which the American Army operated in France in 1918, and because of an overoptimistic idea of the powers of electrical means. Steps are under way in the *Infantry* to revive visual signalling in routine training for its usefulness when all other means may have failed. In any event, until very recently the infantry battalion commander had to use the same methods for controlling his battalion as did the corresponding commander in the Battle of Marathon, but under enormously more difficult conditions.

Now that condition is changing. Recent development in radio has altered the situation. While developing the modern tank, the *Infantry* found itself up against what looked like a stone wall in the battlefield control of these lumbering, noisy, deaf and blind rhinoceri of steel whose collective and individual activity on the battlefield was largely confined to a blind charging about seeking, often unsuccessfully, whom it might trample on. All of the available methods of communication—wire, sound, visual, messengers—were alike useless to control them once the attack was launched. The development of radio sets which could be installed in the tanks and which would enable each tank commander to communicate with those of other tanks and with higher and lower echelons was inevitable. Being inevitable it came about. When, upon the creation of a distinct *Armored Force*, the *Infantry* relinquished responsibility for tank development, provision had been made for radio, both voice and key, in every tank. The lessons learned there were applicable, both in principle and practice, to all *Infantry* troops, and efforts to that end have been intensive. The present development program contemplates extending radio communication down to the rifle platoon, and equipment now under procurement will actually accomplish this.

It goes without saying that in the smaller units close to or actually in the front line light weight and small bulk are paramount. In the foremost elements portability on the person of an officer or soldier also carrying other equipment and having multifarious other duties is essential. The farther back we go the less critical this becomes. The radio equipment of the *Infantry* regiment, known as Radio Set SCR-131, was portable only in the sense that it can be moved from one location to the other in a couple of man loads. It had to be set up on the ground in the new location in order to operate. It could not be operated while being carried, either in a vehicle or on the person. A corresponding set, SCR-171, had greater range, but was otherwise similar and had a wire antenna which had to be set up, whereas the SCR-131 had a loop an-

tenna much easier to install. Neither set had voice operation. They were normally used to parallel the other signal communication net of the regiment, brigade and division, respectively, and added little, if any to mobility. An occasional but unconventional use was with outlying detachments.

The *Infantry* has had a really portable, short range radio set for several years in the SCR-195 or the so-called "walkie-talkie." As its nickname implies, this is a transmitter and receiver combined in a pack load to be carried on the back of a man, and can be operated while in motion if desired. It has voice communication only, and uses a high frequency band. It has been found very useful for special purposes, but is not suitable for use in a command net due to the fact that it does not function satisfactorily in nets of more than two sets.

Radio equipment now developed and in process of procurement will remedy most of the deficiencies in the above three sets. The *Infantry* regiment will shortly have, for its regimental net, a beautiful all purpose radio set which is designed for operation either from a quickly occupied position on the ground, like the old SCR-131 and 171, or from a vehicle, either stationary or in motion. Transmission is by voice or key, depending upon the tactical situation, the time element and the range required. It provides direct contact not only within the regiment but with practically any set in the higher command echelons and with any and all of the supporting arms, such as the *Air Corps, Armored Force* and *Field Artillery.*

The *Infantry* already has in use a vehicular set, developed for use in tanks, permanently installed in a special, half-ton truck. It is furnished to antitank units for use in the warning nets and in the command nets down to and including the companies. It works on both voice and key, with a range, when required, of fifty or sixty miles. These sets also intercommunicate directly with the sets of the *Air Corps, Armored Force* and other associated arms as well as with the regular command sets of the *Infantry.* Since they function perfectly while on the move there is continuous contact and co-ordination among all antitank elements both while halted and on the march, and a speed and simplicity of control in the antitank team fairly comparable with that available to the quarterback of a football team has been achieved. Decision is translated into action with a promptness that augurs ill for enemy armored raiders. This is a realm of communications in which nothing but radio will do the job, and radio is doing it.

When we come to the smaller units —reaching the rifle companies or heavy weapons companies of the *Infantry* battalion and to the platoons of antitank units the same equipment

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Here in America, a Free Radio makes us strong. Uncensored, unchained, broadcasting shares in that "Freedom of Speech" which is written into the American Bill of Rights. The news you hear is undistorted by propagandists. The views you hear are the honest views of commentators who speak without fear of persecution. And *you* are free to tune your radio to whatever you wish to hear.

Union and strength are America's rewards for this freedom. In 48 states, listeners to 50 million radio receivers *believe* the news they hear on the air. They know their radios can be trusted. And this faith is a valuable thing.

Since the beginning of the year, for example (up to October 11) the National Broadcasting Company has winged *979* defense programs into American homes —in cooperation with the Government Administration, the War Department, the Navy, the Treasury Department, Service Groups and Special Organizations. These broadcasts were received by Americans everywhere with enthusiasm and understanding.

Through public service such as this, the National Broadcasting Company continues now as in the past to serve America as only a Free Radio can serve it . . . continues to affirm that here in America, Radio's light of truth must never fail us!

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which is good in the higher echelons becomes unsuitable. The sets are too large and heavy to be carried around in these smaller units, and their range is too great. There isn't room for them to operate without creating serious interference. Something much lighter and handier and with less range, is needed up there in front. The same is true of parachute troops. They need light and handy communications equipment that can be in action as soon as they reach the ground, both for use among themselves and to communicate with the air. In fact, it can be stated as a general principle that any radio set which will do the job for radio troops will also do very well for front line ground *Infantry.*

Such a set has been adopted and is being procured for issue. It weighs about five pounds, receives and transmits by voice on a single crystal-controlled frequency, and has a usable range up to about two miles on the ground and several times that range between a ground station and the air. Officially designated Radio Set SCR-536, it is informally known as "The Galvin Radio." It is furnished for use in parachute units down to the platoon, and in rifle units down to the company. In all these units it deletes the distance factor in the transmission of signals and enables these front line unit commanders to go into a radio huddle before each play. The "fog of battle" is clearing away from our front line elements and some day it may disappear entirely.

It must not be inferred from all this that radio is a perfect medium for military signal communications on the battlefield, or that other means are obsolete. Radio has its draw-backs and limitations. It is subject to jamming, interference and enemy interception, and for that reason it would be foolish to use it when other means will do, and fatal to place exclusive reliance upon it. There must be more than one nail in the horse-shoe. Radio, wire systems, visual signalling and messengers all supplement and reinforce each other. Field wire for *Infantry* is now so light that it can be laid with great ease and speed whenever movement ceases even for a short time, and new sound-powered telephone equipment is so light and handy that it will be used for direct control of machine guns and other heavy weapons as soon as they are in their firing positions and very often even for communication with or within rifle companies. Light signal lamps are being developed and signal flags are furnished for use when nothing else is available. Messengers are still being trained to move by foot, by motor or by air. All these will be used whenever conditions call for them, but radio is the ace in the hole when speed is paramount and the time factor is vital.

Our army has got it, and that horse-shoe is pretty secure.

—30—

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Signal Corps Radio

(*Continued from page* 19)

Enlarged *Signal Corps* duties were made necessary by the expansion of the *Air Corps*, the *Armored Corps* and the *Aircraft Warning Service*.

Signal Corps developments in the field of radio communication for military use have grown by leaps and bounds since 1901 when the first crude sets were operated over a ten-mile range between Fire Island and Fire Island Lightship and across the 114-mile breadth of Norton Sound in Alaska.

The *Army* in general uses many diversified methods of communication and the employment of radio is extensive. The *Signal Corps* has several types of long range sets which are carried in trucks and operated from buildings or tents in important headquarters. There are also light sets carried by hand and operated in the open or from dugouts and trenches and cavalry sets carried by pack horse and operated either from the backs of animals or on the ground. There are special voice and key sets for tanks and armored cars and for airplanes.

There is a complete net of fixed radio stations through whose operation the *War Department* keeps in direct and rapid touch with the whole *Army* both in the United States and overseas. There are 146 stations in this *Army* system and each large headquarters is the central station for its own net through which the corps area and department commanders communicate with the *Army* posts in their areas.

Of the approximately 50,000 licensed amateur radio operators in the United States, the *Signal Corps* has selected some 1,200 for their operating skill and reliability and has organized them on a volunteer basis into various corps area, State and regional nets in the *Army Amateur Radio System* (AARS). This system has given most valuable service in floods and other disasters and a number of its members have been cited for their splendid work and devotion to duty.

Before new commercial products and inventions in the field of Signal Communication can be adapted to military use, considerable modification or even redesign is usually necessary. Such work is done on aircraft radio equipment at the *Signal Corps Aircraft Radio Laboratory* at Wright Field, Ohio. Development of telephone, telegraph, meteorological, radio and all other *Army* signal equipment except aircraft radio is done at the *Signal Corps Laboratories* at Fort Monmouth, N. J. The two *Signal Corps Research* and *Development Laboratories* endeavor to take advantage of the facilities offered by commercial laboratories and commercial developments in the communication field.

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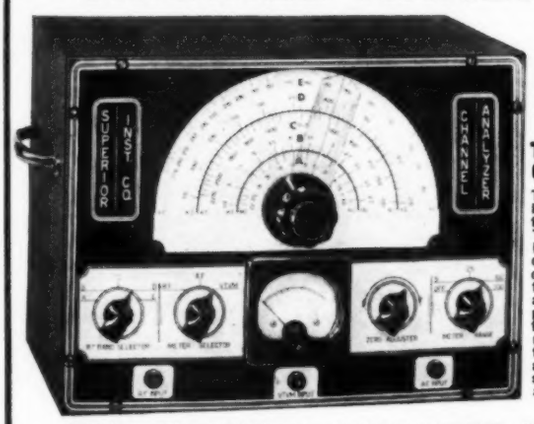

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★ Follow the signal from antenna to speaker through all stages of any receiver ever made.
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★ Measure both Automatic-Volume-Control and Automatic-Frequency-Control, voltages and circuits without appreciably loading the circuit, using built-in highly sensitive Vacuum-Tube Voltmeter.
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The Superior Channel-Analyzer comes housed in shielded cabinet and features an attractive etched aluminum panel. Supplied complete with tubes, three specially engineered shielded input cables, each identified as to its purpose. Also full operating instructions. Size 13" x 10" x 6". Shipping weight 19 pounds. Only.. **$21.75**

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SPECIFICATIONS:

1. Combination R.F. and A.F. Signal Generator, R.F.—100 K.C. to 90 Megacycles, A.F.—200 to 7500 cycles; Sine-Wave.—WITH OUTPUT OF OVER 1 VOLT. All direct reading, all by front panel switch manipulation.
2. R.F. and A.F. output independently obtainable, alone or with A.F. (any frequency) modulating R.F.
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4. Accuracy is within 1% on I.F. and broadcast bands; 2% on higher frequencies.
5. Giant dial etched directly on front panel, using a new mechanically perfected drive for perfect vernier control.
6. Operates on 90 to 130 V. A.C. or D.C. (any frequency).

The Model 1230 comes complete with tubes, shielded cables, molded carrying handle and instructions. Size 14" x 6" x 11" Shipping weight 15 pounds. Only..... **$14.85**

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for comprehensive and often intricate communication increases in direct ratio with the increase in the size of the *Army* and with the growth in the complexity of modern life. While Napoleon's axiom regarding the necessity of providing for the travel of an *Army* on its belly utilizes one of the human senses, it is nevertheless, axiomatic that the *Signal Corps* must provide the apparatus and the methods for the use of the other senses to build the nervous system of that Army.

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Signal Corps Labs.

(*Continued from page* 25)

quent large quantities of materials needed for these developments, it is necessary to have an efficient method of handling these supplies. This is adequately accomplished by the *Supply Section* of the *Signal Corps Laboratories.* The function of this section is to receive all in-coming material and equipment, make a tally report, and distribute same to the proper section. All shipment of equipments from the *Signal Corps Laboratories* to the operational units of the army is also handled by this section.

The *Signal Corps Laboratories' "Shop"* is composed of several subsections, including a modern carpenter shop where beams, cabinets and other models are fabricated from wood, the instrument and machine shop with its lathes, presses, screw machines, and milling machines which fabricate models in steel, brass, copper and other metals, and the welding shop where the model, as fabricated in the shop, may be welded together to form a structurally strong unit. The paint shop is also maintained and operated for the purpose of finishing the models with the necessary protective coats of paint, enamel, etc.

The *Engineering Sections* are divided into subsections of highly trained specialists for concerted research on all developments within the sphere of their activity. In view of the urgency of the situation and in accordance with the fixed policy of the *Signal Corps* as previously stated, only a small part of the actual research on development projects is now done by the *Laboratories'* personnel. However, the highest grade of technician is required and fortunately has been obtained to supervise and coordinate the developments which have been made and are being made. In this connection it is not too much to say that duty at the *Signal Corps Laboratories,* even for a short period of time, is a liberal education for any engineer, physicist or scientist since all radio and wire developments of industry, in fact all such research and development work done in the United States, passes in review at the *Laboratories* and all worthwhile developments are followed up, tested and checked by the *Laboratories.*

The *Field Radio Section* concerns it-

self chiefly with the design of communication equipment to be carried by soldiers on foot, whether for the coordination of infantry movements or for the use of observers engaged in fire control for the *Field Artillery.*

The *Vehicular Radio Section,* as the name indicates, is concerned with the development of equipment for providing adequate communication for the *Armored* and *Motorized Forces.* It has been necessary to develop radio equipment capable of maintaining communication over great distances, to withstand severe shock and vibration while being carried in moving vehicles, and to operate in the presence of terrific local noise interference.

The functions of the *Radio Direction Finding Section* are to develop equipment for use by the *Signal Corps Intelligence Units* to determine the direction and nature of enemy organizations and to locate the direction of friendly airplanes in flight in order to aid in their navigational problems. Interceptor combat squadrons often become separated in accomplishing their mission of defending fortified zones in night operations. It is the function of one type of direction finder to aid in bringing the planes back to their home fields without disclosing information to the enemy.

The *Wire Section* has the assignment of developing telephone switchboards, field printing apparatus, wire reels, and devices for carrying wire and cable, the setting up of standards for wire and multi-conductor cable, plugs, and fittings necessary for equipping the field operational units with equipment for military use.

The activities of the *Sound and Light Section* include development of equipment for signalling purposes and also sound ranging equipment for the location of enemy forces.

The *Meteorological Section* develops special equipment for the purpose of obtaining meteorological data for use by the various branches of the Army.

The *Thermionic Section* concerns itself chiefly with the development of thermionic tubes of a special type, not commercially obtainable, for operation in high frequency ranges.

The *Radio Position Finding Section,* as the name indicates is concerned with the development of apparatus for the determining of position of enemy forces by means of radio. This work has been carried on by the *Signal Corps* and *Navy Laboratories* over a period of many years.

So far as known, the first successful development of this character anywhere in the world was consummated by the *United States Naval Research Laboratory.* The work of the *Signal Corps Laboratories* has been closely coordinated with that of the *Naval Research Laboratory* and later with that of industry and the *National Defense Research Council,* so that at the present time the *Signal Corps Laboratories* has an outstanding position in this field.

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CAA

(*Continued from page* 58)

range plans of the *Civil Aeronautics Administration* and Schedule B will then be used to connect the 23 Airway Traffic Control centers about the country.

Transmission on the interphone is by the usual microphone and reception is through loudspeakers and head sets. The sender gives the call-letters of the station to which he wants to talk, and in some cases, uses a button to ring a bell at the destination. There are between six and 18 stations on a circuit.

The *Civil Aeronautics Administration* has long supplied round-the-world meteorological broadcasting system, using its intercontinental stations at New York, on the Pacific Islands and large stations are being built at San Francisco, Honolulu, New Orleans, and Everett.

The New York station works five circuits, between New York, Montreal, Shediac and Newfoundland; New York and Bermuda; New York and Horta; New York and Lisbon and New York and Bolama, Africa. Two circuits at the station are for handling aeronautical communications on the northern trans-Atlantic route via Newfoundland and the British Isles and another for the southern route via Bermuda, the Azores, Portugal and return by Africa and South America.

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Armored Force

(*Continued from page* 38)

A ROARING thundering noise makes the pedestrians look around as if there were an airplane swooping down over Main Street of a peaceful little village near Fort Knox, Kentucky. All of a sudden, this tank comes to an abrupt stop. A steel fishpole crazily wobbles and vibrates in the wind. A passer-by asked if the men in the tank were going fishing with that fishpole. He was told that it was the antenna for the radio set in the tank.

As we mount the tank and look down through the top of the turret, we see a transmitter mounted on a shock-absorber device and another steel cabinet housing a receiver also protected from vibration. We see another unit that appears to be a motor or generator. It is both; Dynamotor is the name given to the power unit supplying filament, plate, and grid bias voltage to the transmitter. A smaller dynamotor is connected to the receiver for its operation. What is the box with switches? It is the control box. The switches turn on and off the dynamotors for both the transmitter and receiver. The various units just mentioned above are connected together by means of cable. This

Don't miss next month's special constructional articles.

cable not only means a neat-appearing installation, but keeps the wires well protected as they take a great many shocks especially going through woods when the tank knocks over a tree of ten-inch diameter.

We see that there are portable radio sets in use in the *Armored Force.* These are in the ultra-high frequency range and are voice sets only. At the other extreme from portable sets, we see the 400-watt transmitter with associated receivers installed in a large truck and trailer combination. This truck-trailer which serves the more stationary headquarters is normally worked while stationary, but it can move out with the headquarters. This truck-trailer is also equipped with teletype machines.

There is a very definite service and maintenance problem on the sets used in vehicles of the *Armored Force.* The ideal situation is having spare sets to replace broken-down sets. It is quite simple to remove a unit and replace with a new one. This also means that the radio is out only a short time as compared to perhaps a day or two while the particular unit was being repaired.

In designing a new radio set, there are first set up certain definite military characteristics determined by experience in the field by officers and men who have been handling communications. Many factors limit the characteristics. Size of the set is quite critical especially in tanks. Sometimes it means removing a machine gun and ammunition space to install a radio set in a tank. Weight is not so critical, but must be kept to a minimum. Power supply for the transmitter and receiver is the vehicular battery, usually twelve volts.

In deciding what range the set must have, a careful study must be made of the units for which it is being designed. If the vehicles are normally on reconnaissance missions, longer range equipment is necessary to provide communication at this distance.

The antenna is a limiting factor on the distance range of vehicular radio. When in a stationary position for any length of time, a better antenna can be strung up to get more efficient use of the equipment.

The frequency range is rather limited. We just can't ask for the range of 4,500 kcs. to 6,000 kcs. because there are many other agencies using frequencies of this band. Many government agencies such as the *Coast Guard, Ship-Harbor Telephone, Navy, Justice,* and *Immigeration* and *Naturalization Service, Army Airway stations, Agriculture* and *Forest Service,* many commercial airways and other networks work on frequencies in bands used by the *Army.*

So when an *Army* set covers a certain band of frequencies, that does not necessarily mean that with the particular set you have been operating that you will be able to operate on any frequency, or that possibly you

will have exclusive use of the band.

In a tank, because of the motor noise and noise of firing, a throat microphone is often used. The operator has to use the throat microphone a little while to become accustomed to it and to produce best results. Frequency stability must be specified and the manufacturers' model must have these rigid characteristics or it will not be accepted.

There is always an approximate range in miles given in the proposed military characteristics. This figure is the number of miles that should be obtained under even the most severe conditions.

Under favorable conditions, two or three times the specified range can be obtained. The range while moving is roughly two-thirds of the distance range while stationary. Track static has been encountered in the past, but due to improved tracks very little is noticed on present tanks.

Another of our problems is the vehicles which are not radio equipped. These vehicles cause interference with their ignition upon coming close to the radio-equipped vehicles.

A few of the characteristics desired in a tank radio have been mentioned in the previous paragraphs. The designer of *Signal Corps* radio sets for tanks have a few problems to meet, but they always produce a set that comes through with flying colors. A radio set is as much a part of a tank today as the machine guns that are mounted on it.

It is comparable to a ship without a rudder to have a tank without a radio. Although, as mentioned before, there may be periods of radio silence, this does not mean that the receiver cannot be turned on to monitor or guard a certain frequency or frequencies.

The *Armored Force* is continually making use of new and proved improvements in vehicular radio transmitters and receivers. So if you ask whether we are using a certain system of radio or special devices with it, you can be assured that the *Armored Force Board* has either made a thorough study of it or has set up a project to determine what is desired in order to procure a model or models for a very thorough trial. Every day, the *Board* receives representatives or correspondence offering super-super gadgets or machines as a means of taking care of all communication problems.

It is up to the radio operator and radio electrician to get the messages through and cleared in the shortest time possible and to keep the radio maintained and in operative condition. Now we look back at the engineers who had to produce this set to meet those high standards. We take off our hats to them for the part that they have done so well in making the tank come to life with a magic voice that can speak over miles while roaring across country to accomplish its mission of training men or in the actual defense of our country.

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NBC

(*Continued from page* 73)

H. LaGuardia, *Director of Civilian Defense,* participated in a demonstration of the ingenious new RCA Alert Receiver. Word that "enemy" planes had been sighted over Long Island was relayed from Mitchell Field to Radio City. There a civilian defense official pressed a button that sent a robot signal, completely inaudible, over the carrier wave of Station WJZ. That signal tripped a relay in the Alert Receiver whose loudspeaker was then ready to receive any message the defense official had to transmit.

The robot wave may start a siren to warn the public. It may set a bell ringing on the Alert Receiver to awaken sleeping air wardens, or it may be the impulse that lights various colored signal lamps on the front of the receiver.

In the all-out effort to defend democracy, radio broadcasting stands as a great national asset. Technically, its great power derives from the base fact that American radio can carry a message from one source simultaneously into practically every home in the land. Greater, however, is the fact that our people have faith in the American system of broadcasting. They know its impartiality in dealing with news and opinion, its initiative in presenting fine entertainment, its conscientious efforts to use an incomparable instrument of mass communication for the high purposes of education.

Today American radio commands the loyalty of 100,000,000 regular listeners.

Two things are essential to the maintenance of national morale by radio. The first is an uninterrupted flow of information and news to the American people. The second is a continuance of entertainment, and aids to relaxation, to lift up the spirits of the people in times of stress; to help preserve, as far as possible, the pattern of normal life.

Radio's part in gathering and spreading news, views and opinions needs no review here. President Roosevelt's recent tribute admirably expressed radio's achievement as a news agency. "Today the need is greater than ever that broadcasting should perform its function as a medium of public information," he said. "Factual and accurate news made available to all of our people is a basic essential of democracy. Radio has done its job well in this field." Radio should be permitted to carry on that tradition of accuracy and freedom. —30—

The Columbia Broadcasting System and the Mutual Network are fully organized to handle any emergency that may arise. Space does not permit a complete analysis of the situation. We find our great broadcast nets prepared to transmit all information of interest to the American public.—Editor.

Convenient Buyers Guide on Page 109

Police Radio

(*Continued from page* 74)

State police radio systems usually consist of several stations strategically located throughout the state and may be operated at a maximum power of 5,000 watts during the day, 1,000 watts at night. Thirty-two states, now operating a state-wide radio system, are highly efficient communication organizations experienced in handling police traffic and despatching patrol cars.

Municipal and state police stations are licensed only to operate by radio telephone, however, radio telegraph plays an important role in handling routine police traffic. The two types of stations classified to operate radio telegraph are zone and interzone stations. A zone station is allowed to communicate only with other such stations within a zone, and an interzone station allowed to communicate with other such stations and zone stations. As a general rule a zone is classified as a state.

Almost every police radio station communicates with one or more neighboring municipal or state stations.

During the recent army practice maneuvers, police radio vividly displayed its value to our military forces. The Louisiana state police, under the direction of Supt. Steve Alford, took part in the activity in that state in the following manner:

The Military Police officers assigned to the two armies taking part in the maneuvers were sent to the state police school conducted at the Baton Rouge headquarters several months before the start of the games. Those passing were given state "Special Agent" commissions and wore state badges along with their military police badges. They, of course, had full state trooper powers over highway traffic both army and civilian. A captain, lieutenant, sergeant and sixty troopers were assigned to each division.

The "blue" army camp used radio station KSPB 250 watts at troop D headquarters in Lake Charles, the Provost Marshal of the blue army using the state headquarters for their office. The "Red" army camp was set up at Jonesboro, and as no state radio station is located there, a 250-watt portable unit KSPI was set up in the state police office, with the *Provost Marshal's* office in the city hall building.

There were ten radio-equipped state police patrol cars assigned to each detail and they were operated day and night usually by one state trooper and one member of the military police. All highways in the maneuver area were posted with large signs warning civilian traffic to reduce speed to 35 miles per hour. It was the duty of the patrols to enforce this law and to keep the highways clear for both army and civilian traffic.

Radio orders to the cars during the actual fighting ordered civilian traffic from certain highways due to truck and tank movements, then re-routed all civilian traffic over side roads until the main highways were clear.

All convoys under way in the state were handled by one patrol car and two motorcycle officers. Orders to the convoy when under way was routed by state police radio to the patrol car at the head of the convoy which contained the army officer in charge of the convoy. Army officials noted that this method of handling convoy movements was far better than their method of sending code messages via their signal corps radio.

One of the most used services of the state police radio system by the army was assisting in the handling of airways weather messages. The Army Air Corps had fields scattered over the state and out of touch with regular weather stations. The state stations gathered weather reports from Monroe, Baton Rouge, New Orleans and

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Lake Charles, CAA weather stations and broadcast them on regular schedule. All patrol cars near an airfield copied the message and delivered it to the officer in charge of the army airfield.

Another service of the system was the locating of soldiers on duty in forests and delivering to them personal messages concerning sickness or death. When all other methods of locating them failed, the message was broadcast and patrol cars made the rounds of the camps in their district locating the soldier and delivering the message.

When it was necessary for the third army to use the Texas highways for the tanks in their drive on the new "Red" army camp at Shreveport near the close of the games, the state police stations contacted the Texas highway patrol station KTXA at Austin, Texas and made the necessary arrangements for their escorts and the blocking of the Texas highways to civilian traffic during tank and truck movements.

Police radio is also proving its value in co-operating with Naval training stations. The larger of these stations have their police and guard work attended to by a staff of Marine Corps officers and men headed by a provost marshal. It is their duty to guard all entrances to the station, keep watch at the brig, and help in maintaining order throughout the grounds.

The station intelligence consisting of Naval officers and men do the investigation work and keep the station records, etc., however the actual police work is handled by the Marine Corps.

Two-way radio communication between the provost marshal's office and car and the local police radio station has already shown its great importance in case of disorder and escapes. If a military prisoner should escape from the grounds, the local police station or stations can be notified instantly, who in turn can despatch their patrol cars to the roads surrounding the Naval station.

The foregoing illustrations show definitely that co-operation between local and state police departments and the militia have strengthened our National Defense program. The knowledge and experience gained by our police radio men through 13 years of experience in building up one of the largest radio communication networks in the country will display itself more and more as our defense activities increase.

Police radio communication men throughout the nation are co-operating full-heartedly with the program by offering their facilities to the government, and assisting in every way possible the establishment of two way contacts between the various government agencies and their own police departments.

They are a small but important group of technical men doing their part in making our National Defense program a success.

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Air Corps

(*Continued from page 29*)

system is to permit landings to be made under conditions of restricted visibility.

The radio-landing system used by the *Air Corps* has to be of a more or less portable nature, including the ground facilities. Radio landings as developed by the Army are negotiated by use of the following facilities. On the ground, two transmitting stations are located along the projection of the center line of the longest runway emitting a tone-modulated transmission. The transmitters operate on two different frequencies in the low frequency band (200-400 kilocycles) with a power output of 50 watts. A vertical antenna 30 feet high is used at each station. One station is located two miles from the approach end of the runway and the other is located approximately 1,500 feet from the same end. A low-power high-frequency marker beacon transmitter operating at 75 megacycles (4 meters) is located at each of the above locations; the one at 1,500 feet is referred to as the "inner" marker and the other the "outer" marker.

The military aircraft are equipped with a radio compass and a marker beacon receiver which, when activated by a signal of a radio marker, flashes a light on the instrument board of the plane indicating to the pilot that he is directly over a marker in the same manner as when passing over a radio range marker.

Approach is made to the field by use of a radio compass tuned to one of the stations. The course is established on a line between the two transmitters, flying back and forth as many times as is necessary to correct the course for drift on the directional gyro. After establishing this course and coming in for a final approach to the field, the pilot descends until he is at an altitude of 800 feet over the "outer" marker and continues his descent until he reaches an altitude of 150 feet over the "inner" marker near the end of the runway. A continuation of this rate of descent brings the plane into a landing. Considerable development work has been carried on to perfect this system in order to warrant definite use in inclement weather and the absolute reliance on an instrument landing system.

One of the problems consists of the design of a more efficient antenna for use on each type of airplane. It is reasonable to assume that an antenna designed for use on a pursuit ship would not be suitable for use on a bomber and vice versa.

An aircraft transmitter antenna should give out waves in what is called a "doughnut" pattern. The maximum wave radiation should go out horizontally with little radiation going up into infinity or straight down to the

Statement of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Radio News, published monthly at Chicago, Illinois, for October 1, 1941. State of Illinois, County of Cook, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared A. T. Pullen, who, having been duly sworn according to law, deposes and says that he is the business manager of Radio News and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; Editor, B. G. Davis, 608 S. Dearborn St., Chicago, Ill.; Managing Editor, O. Read, 608 S. Dearborn St., Chicago, Ill.; Business Manager, A. T. Pullen, 608 S. Dearborn St., Chicago, Ill. 2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Ziff-Davis Publishing Company, 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff Co., 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; Amelia Ziff, 608 S. Dearborn St., Chicago, Ill.; B. G. Davis, 608 S. Dearborn St., Chicago, Ill.; Sylvia Davis, 608 S. Dearborn St., Chicago, Ill. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.) A. T. Pullen, Business Manager. (Signature of business manager.)

Sworn to and subscribed before me this 3rd day of October, 1941.

[Seal.] M. Gnass, Notary Public. (My commission expires February 26, 1944.)

ground. The pattern of radiation is determined largely by the plane's size and shape, since the modern all-metal military ship itself acts as a part of the antenna. Yet it differs from a ground transmitting station because with the plane flying unattached high in the clouds—it has no ground connection. By using a miniature transmitting set in a scale model of a fighting plane which, in turn, is mounted on a pole on a tall tower constructed entirely of wood with the exception of the use of a few bolts of a nonferrous metal, located a considerable distance away, the engineers can find the pattern a field of radio waves will take as they emanate from the model, which may be placed in various positions of flight. A field strength meter is used in measuring the wave intensity. The use of this tower was introduced after similar tests made on the ground disclosed a considerable error percentage from calculated performance. It was found that in order to simulate transmission of radio signals from a plane in flight, the model had to be raised off the ground.

The problem of maintenance is a problem of gigantic importance requiring a considerable amount of test equipment and other facilities, the most important factor of all being trained personnel to maintain the operating efficiency of the *Air Forces'* radio equipment. The radio amateurs of the United States constitute a large percentage of radio operators and technical personnel in the *Air Corps.*

These men, although experienced in the fundamentals of radio communications and maintenance, are sent to one of the *Army Air Corps Radio Communication Schools* where they are indoctrined in the *Air Corps* technique of operation and maintenance. They are taught the operation of the various types of radio equipment used on the planes along with the theory and operation of the radio compass and other aids to air navigation. The students upon graduation are assigned as aircraft radio operators or aircraft line maintenance radio mechanics.

The *Army Airways Communications System* at the present time gets most of its personnel from graduates of these schools. A course of specific instruction for training personnel for duty with the *Army Airways Communications System* is contemplated for the purpose of training graduates.

The Air Corps is appreciative of the sacrifice made by the radio amateurs in relinquishing the use of certain frequencies in the interest of National Defense. The lack of suitable frequencies in the radio spectrum necessitated the obtaining of frequencies between 3,650 and 3,950 kilocycles for use at the basic and advanced flying schools in order to provide suitable channels for communication of instructions and protective advice to students in the air, training for service with the *Air Forces* of the United States.

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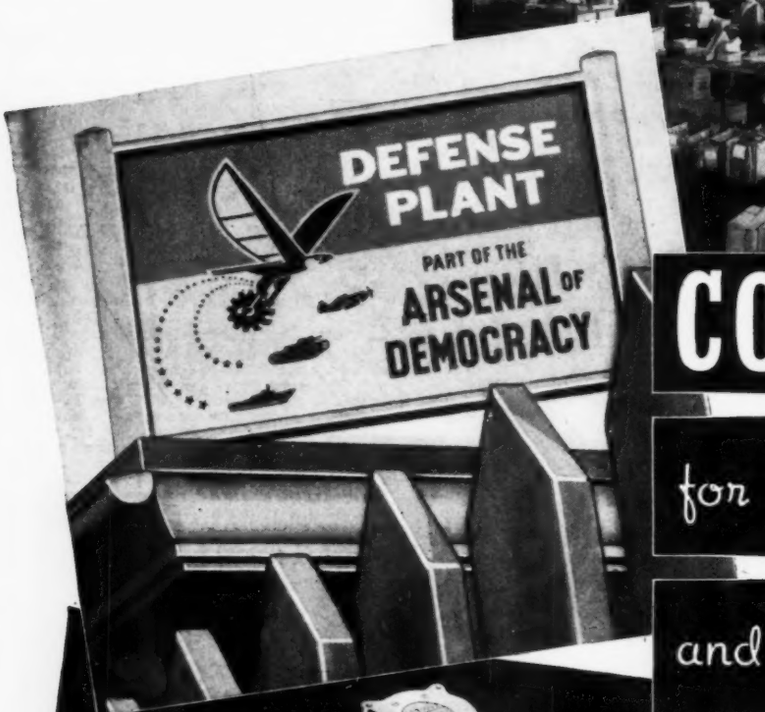

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